Design Engineering

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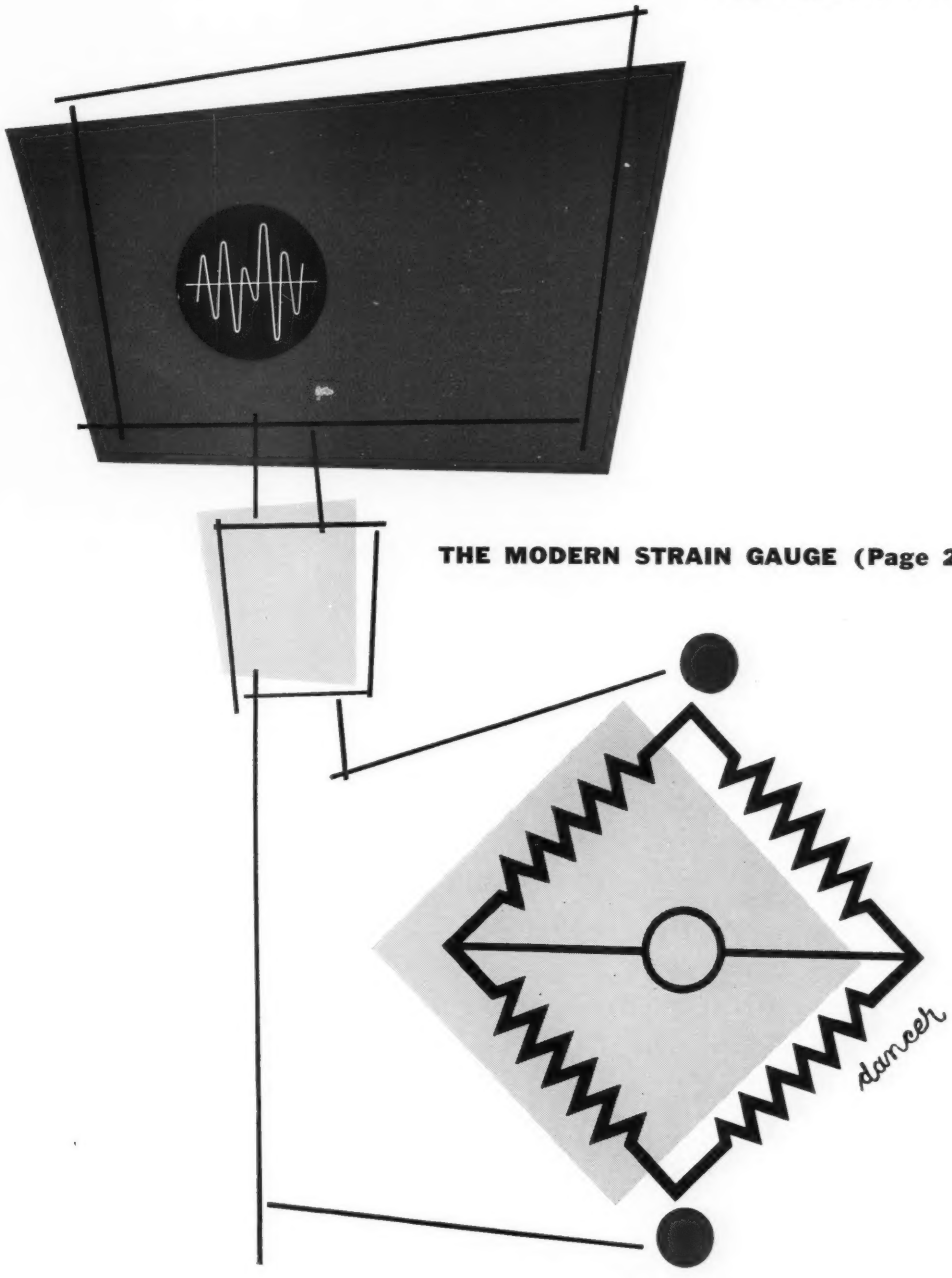
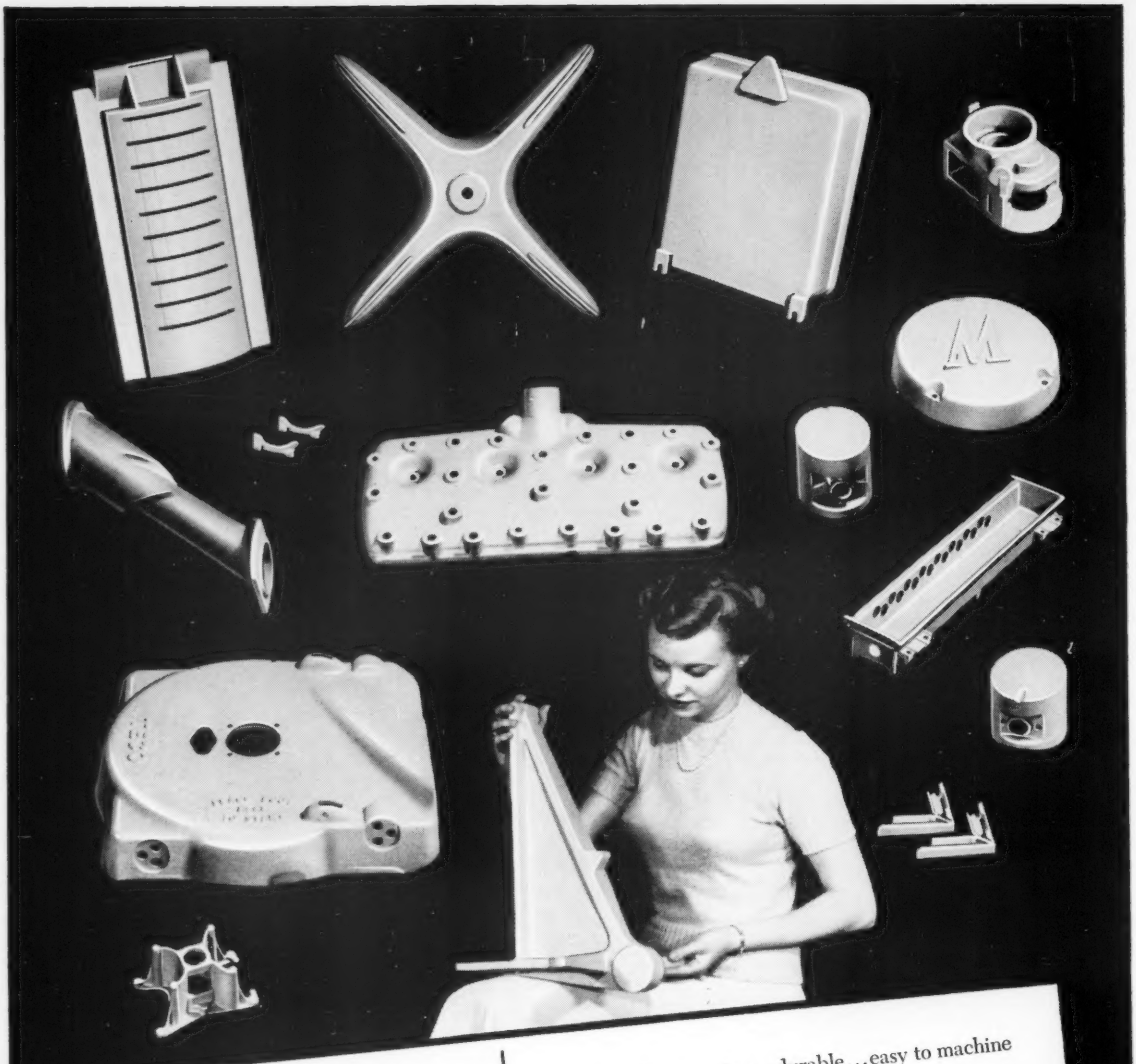


THE MODERN STRAIN GAUGE (Page 21)

Put strain gauges to use in design
Industry turns to infra red baking
New U. S. destroyer, 15 years ahead

August 1955

PUBLISHED BY MACLEAN-HUNTER PUBLISHING COMPANY, LIMITED, TORONTO, CANADA



ALCAN ALUMINUM CASTINGS

offer a matchless combination of advantages for hundreds of parts and purposes

Light and labor-saving... durable... easy to machine ... rustproof and corrosion-resistant ... less expensive to ship and easy to handle ...

These are but a few of the reasons why so many parts are being cast today in Alcan Aluminum Alloys — by sand, permanent mould or die-casting processes. Weighing thousands of pounds or a fraction of an ounce, simple or intricate in design, aluminum castings are being profitably used for countless applications by manufacturers across Canada. Your nearest Alcan sales office will gladly assist you to design castings for your particular needs.

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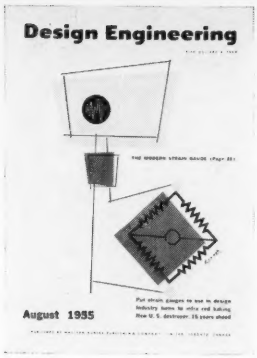

Design Engineering

VOLUME 1 **AUGUST, 1955** NUMBER 5

This month's cover

A reader called in to meet DESIGN ENGINEERING'S editors while production of this issue was under way. He studied the "strain gauge" cover artwork carefully. "This is going to take some explaining," he said after giving up. But is it so obscure? Aloft is the oscilloscope, beneath it the amplifier and, lower right, the Wheatstone bridge to measure unbalance. Where is the strain gauge itself? Well, as the author says, it is a very undistinguished looking object and hardly cover material. So the artist chose to let it hide somewhere behind the Wheatstone bridge.

Design Engineering

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MANAGER, INDUSTRIAL NEWSPAPERS

Editorial correspondents in: The United Kingdom, the United States, Germany, France and Italy.

The September issue of **Design Engineering** will carry strong feature articles written by contributors no less experienced than those featured this month.

Powder metallurgy promises new opportunities for engineers in the future. Now a well-tested technique, it is fully covered in the September issue.

Industrial design is growing in importance to engineers. It will be ably discussed by a Canadian graduate engineer—industrial designer.

Wired TV in industry is another feature from one of our English correspondents.

Special Artwork

Editorial layouts designed by art consultant **Desmond English.**

Inside

Leith

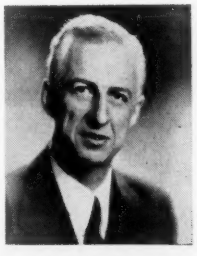
THE UNDISTINGUISHED-looking strain gauge takes principal place (page 21) in this issue of DESIGN ENGINEERING. It does so because of its growing importance in design work where heavy stressing has to be assessed. The article comes from **W. C. Leith,** a mechanical research engineer for Dominion Engineering Works Limited. He did much postgraduate work on strain gauges, has seen his findings successfully used by his company's several engineering departments. He points out that these gauges will help you to design better products at lower cost.

Kemp

THE STORY of the Dowty High Delivery valve (page 26) is told by technical writer **T. M. Kemp.** He is a 27-year-old Torontonian in charge of technical publications for Dowty Equipment of Canada. Besides technical writing, he recently took on another "major interest" which he describes as, "adjusting to the bewildering state known as wedded bliss." So far he has had only nine weeks to do so. But has a broad experience of tool and product design.

Harper

FORTY-FIVE years ago, Englishman **Alan Harper** first came to Canada as a boy of 10. After attending one of England's famous "public" schools and then Cambridge University, he went to work for the Armstrong Whitworth and other English companies. But he did not forget Canada. And, in 1928, he came back. He has stayed here since. He has been 24 years with the Northern Electric Co., now holds the position of publications manager. With long experience to help him, he contributes the timely article on modern infra-red baking (page 29).



Biggar

DO ENGINEERS have an internal selling problem? **Percival Biggar** answers the question with a "yes" (page 32). He discusses the best ways for an engineering department to put up its new ideas to management. It makes the difference, he says, between an engineering department that "potters along" and one that is vital to the health of the whole enterprise. After working for the Packard Motor Car Co., and later for Leyland Motors, England (where he rose to become chief designer) he is an authority.

Now 40% HIGHER H. P. RATINGS WITH NEW SUPER-RATED HY-T V BELTS

- INCREASED SERVICE LIFE
- HIGHER SHOCK LOAD RESISTANCE
- LONGER FLEX LIFE
- LESS STRETCH

Recognizing industry's need for a more shock-resistant, more durable V-belt, Goodyear developed Super-Rated HY-T V Belts.

Chemically-produced fibre cords are the secret of Goodyear's success with HY-T V Belts. These tough, sinewy fibre cords soak up the gruelling punishment of shock loads and high speeds. HY-T V Belts have exceptionally long flex life with little or no stretch in use.

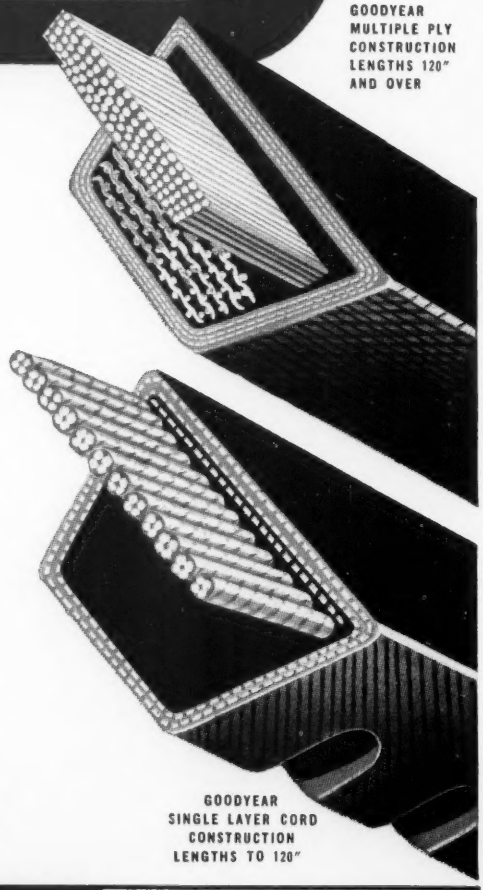
Without sacrifice of service life, HY-T V Belts have 40% higher H.P. rating—seven belts can do the work of 10 or the same number of belts will substantially increase belt service life.

Goodyear HY-T V Belts are engineered in two types:

(a) Single layer cord construction with deep notches that dissipate heat and provide grip on small pulleys.

(b) Multiple ply construction for long, heavy duty drives where greatest shock loads and strains are encountered.

Goodyear HY-T V Belts have oil resisting covers, are mildew inhibited and can be supplied static-conducting. Every test indicates you can't buy a better answer to your V-belt problems.



GOODYEAR MULTIPLE PLY CONSTRUCTION LENGTHS 120" AND OVER

GOODYEAR SINGLE LAYER CORD CONSTRUCTION LENGTHS TO 120"

GOODYEAR

INDUSTRIAL RUBBER PRODUCTS ENGINEERED FOR THE JOB

For details on new HY-TV BELTS contact your nearest Goodyear Branch at — Moncton, Saint John, Quebec City, Montreal, Toronto, London, Windsor, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver, or Head Office, New Toronto.

Reports

News in brief from the world's producers

EQUIPMENT FOR ELECTRIC induction re-heating of steel ingots for rolling has been installed by **Western Canada Steel Ltd.,** of Vancouver.

The process will revolutionize re-heating of steel ingots or billets for rolling in any part of the world where there is a plentiful supply of electric power. The time for reheating ingots is cut by about 75%. Previously it took about 45 minutes to heat ingots in an oil-fired furnace; present time to red heat is 12 minutes.

Production is increased 30% and fuel costs are cut by $1 a ton. The total annual finishing capacity at the rolling mills will be around 70,000 tons as against 40,000 tons previously.

• • •

FOR THE Bersimis-Lac Casse development of the Quebec Hydro-Electric Commission, **Metropolitan-Vickers** are making four vertical water wheel generators. Each is capable of an output of 138,000 kw at 277 rpm, so that these generators will be the most powerful in the world.

• • •

A NEW FOUNDRY of the **St. Catharines Brass Works Ltd.,** specially equipped to produce high nickel cast alloys and licensed to cast special ferrous products is now in production.

The new plant of the 46-year-old company covers 12,000 sq. ft. of floor space in St. Catharines newest industrial area south of the Queen Elizabeth Highway. Six oil-fired pit furnaces permit close control of melting operations for such high nickel alloys as monel, inconel, cupro-nickel and nickel silver. A cupola for producing ductile iron, ni-resist and ni-hard under license from The International Nickel Co. of Canada, Ltd., has a capacity of 2 tons per hour.

In addition to its modern casting equipment, the new foundry has a 10,000 ft. lb. electro-pneumatic hammer for forging a wide range of alloys including monel and "K" monel.

• • •

AN OPEN INVITATION to Canadian firms to join in the expansion of Northern New York by locating branch plants on the south side of the St. Lawrence River has been issued by Commissioner Edward T. Dickinson of the **New York State Department of Commerce.**

Speaking before the New York State Chamber of Commerce Executives Summer Conference at the Hotel Woodruff, Watertown, New York, Commissioner Dickinson stressed that a 20-year trend marked by the flow of American industry into Canada is now being reciprocated, and many Canadian manufacturers find they can benefit by serving the U. S. consumer market from branches in New York State.

"New York State," added the Commissioner, "is looking for new industry. It has the markets for the absorption of consumer goods, the greatest consumer market, in fact, in North America. It has need of extra employment, which new factories and branches can provide.

"There is no reason why the natural expansion of Canadian firms should be halted at the international border. Such close proximity is beneficial, since management is not spread too thin, and production and distribution can readily be co-ordinated. It is obvious that the ties between our two countries are being more closely knit than ever.

"I can assure all Canadian firms desirous of locating in the state of the full co-operation of the New York State Department of Commerce and Governor Harriman."

• • •

THE RECENT appointment of **Data Processing Associates Ltd.,** Ottawa, as the exclusive Canadian representative of **ElectroData Corp.,** California, is announced.

ElectroData are designers and makers of the modern high speed Datatron electronic data processing machine. Datatron electronic digital computers offer two basic tools for "dynamic management"—speed and versalitity. Datatron will perform in a few seconds many intricate computations and data reductions which normally take hours to accomplish with older methods used by industry, science and business.

The Datatron electronic data processing system is available on short delivery and may be procured on lease or sale.

Data Processing Associates is an independent all-Canadian company specializing in high speed data processing and data reduction.

• • •

BUILDING WORK on their new plant at Fort William, Ont., has ended, announce **Linde Air Products Co.**

Equipment is now being installed. It will be late summer until this part of the job is finished but, in the meantime, part of the plant is already producing. The official opening is being postponed until final completion.

The company supplies oxygen, acetylene and machines and apparatus for welding, cutting and flame treating steel and other metals. It also supplies oxygen to hospitals and for high altitude flying.

• • •

A PLANT WILL be opened this year at Stratford, Ont., by the **Canadian Westinghouse Co.** for the manufacture of small motors,

When completed and in full production (by early 1956) the new plant is expected to employ between 100 and 125 people. Location will be on No. 7 Highway at Lorne Avenue with floor space covering 270 ft. by 140 ft. on a 24-acre site.

Building operations will begin about mid-July and the factory will be ready by about December 1. With the exception of a few key men who will come from Hamilton, the new industry will staff with local factory and office help.

The new plant will be completely modern in design. A railway siding in the rear will supplement transport shipment.

The "Datatron" for dynamic management

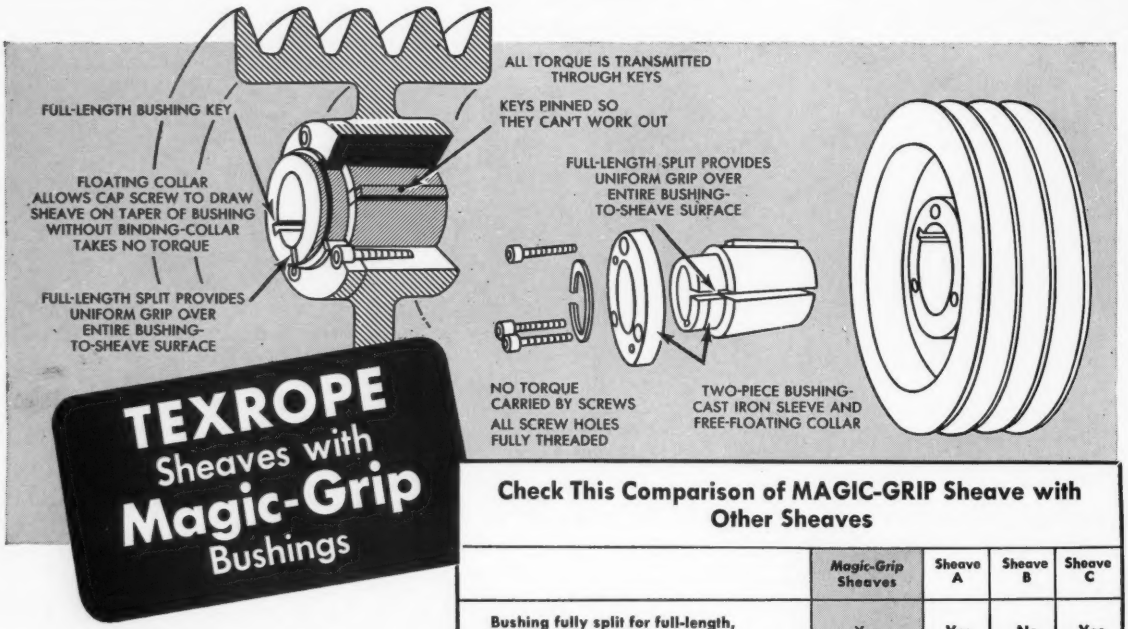
Only MAGIC-GRIP Sheaves Give You These 4 Most-Needed Features

1 Full-length contact between bushing and shaft. Sheave can't get out of alignment or develop excessive run-out because pressure is applied equally all around bushing along full length.

2 Torque between bushing and shaft, and between bushing and sheave is transmitted by keys instead of threaded screws. Thus jamming of screws from shock overloads is eliminated.

3 *Magic-Grip* Sheave installs quickly, easily as a unit instead of in two pieces — simply slip sheave on shaft and tighten screws. Complete sheave can be moved back and forth on shaft to adjust position.

4 Cap screws in *Magic-Grip* Sheaves are full-threaded, engage full thread instead of partial. This ends stripping and jamming problems.



Check This Comparison of MAGIC-GRIP Sheave with Other Sheaves

	Magic-Grip Sheaves	Sheave A	Sheave B	Sheave C
Bushing fully split for full-length, full-circumference grip	Yes	Yes	No	Yes
Torque carried by keys instead of threaded bolts	Yes	No	No	No
All screws engage all threads fully	Yes	Yes	Yes	No
Mounts in one piece	Yes	No	Yes	Yes

All Allis-Chalmers sheaves are available with *Magic-Grip* bushings. For complete information contact your nearest authorized *Texrope* drive dealer, or CA-C Sales Office or write direct to Canadian Allis-Chalmers Ltd., P.O. Box 37, Montreal, Quebec.

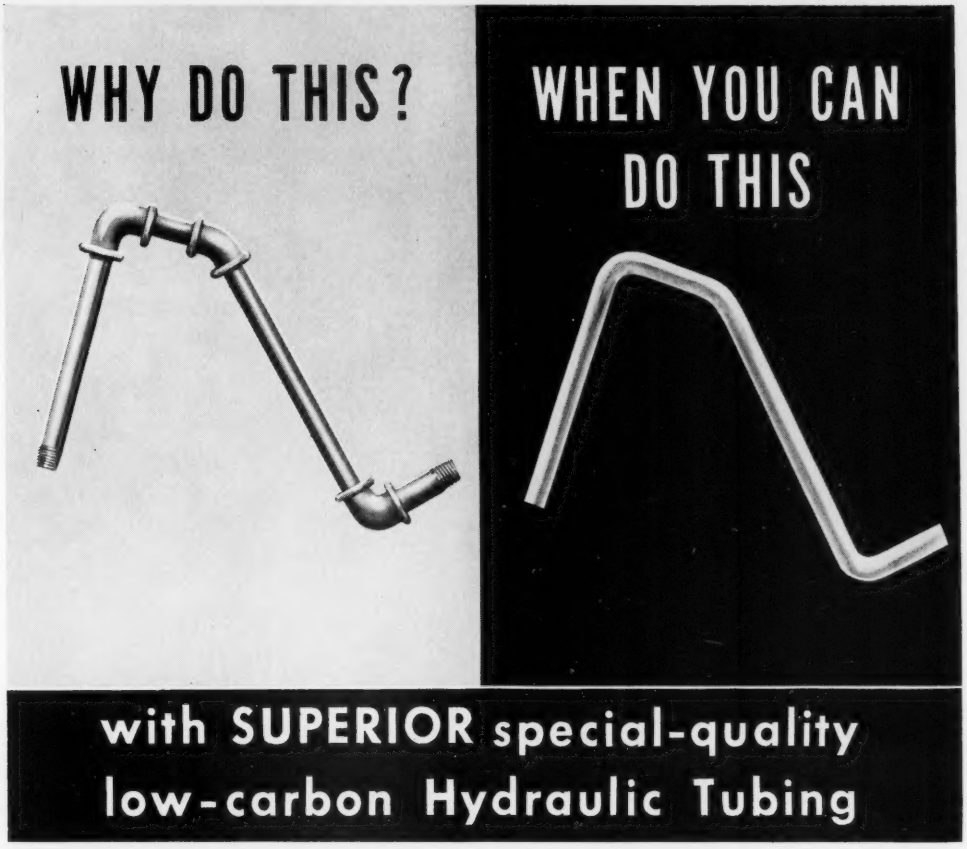
MADE IN CANADA

CANADIAN ALLIS-CHALMERS

Texrope and *Magic-Grip* are Allis-Chalmers trademarks.

55-CAK-4

THE LYMAN LINE OF LEADERS



Why use more fittings than you have to when you can make those long low-friction sweep bends so easily with Superior's special cold-drawn seamless hydraulic tubing?

This is the tubing that gives you more strength with thinner walls, the same bore for a smaller O.D., the tubing that bends to the tightest of radii . . . and is so smooth inside that there is no possibility of chips or scale getting into the equipment.

All Superior hydraulic tubing receives a 100% hydrostatic test before delivery and each order is tested for flareability. You may specify Superior tubing in any size from ⅛" to 1⅛" O.D. from warehouse stocks. Our new folder gives sizes, wall thicknesses and recommended maximum working pressures. The coupon will bring you your copy.

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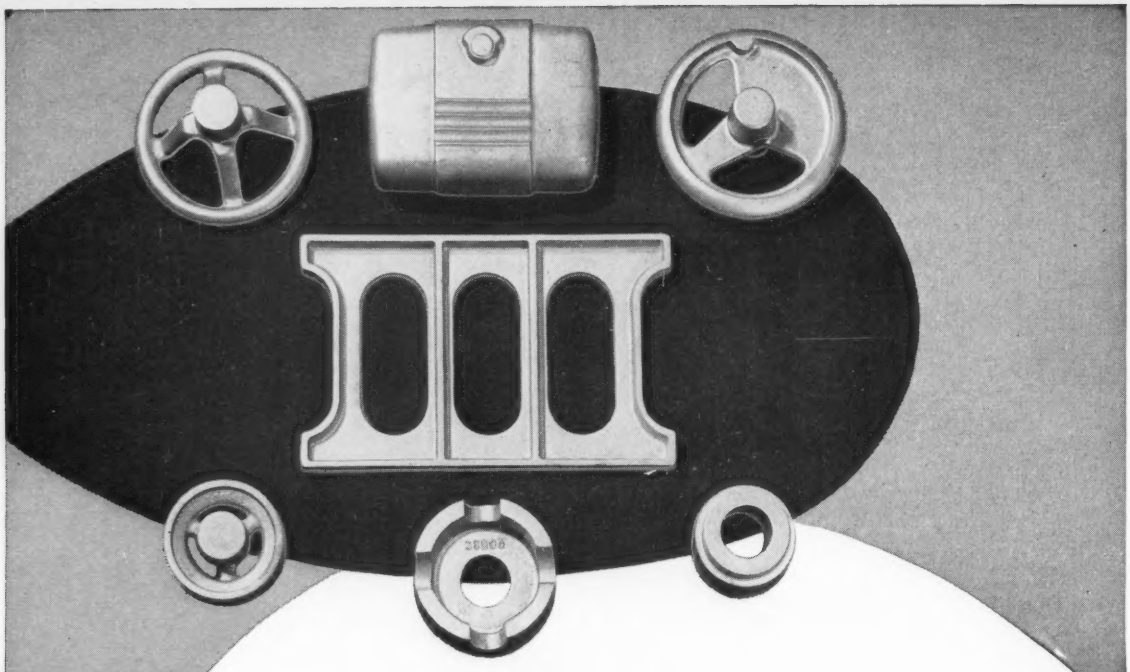
Representative: New Glasgow, N.S.



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An Eureka Casting is a Precision Casting — a faithful reproduction in every minute detail.

You have freedom in designing — include bosses, fillets, openings, ribs, identification marks, instructions or directions.

Design patterns can be altered quickly and economically.

An Eureka Casting can be easily machined, polished, plated or painted.

Obtainable in alloys of gray iron or aluminum in any size, shape or weight.

LICENSED USERS OF FRONTIER 40E HIGH STRENGTH ALUMINUM ALLOY

Eureka

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WOODSTOCK ONTARIO CANADA

The *All-Metal* Multi-directional Mounting*

ROBINSON originated

and universally APPLIED

ROBINSON Series 9300 plate type double acting multi-directional mount shown here in actual size No. 1, and available in any size required. Load ranges per mount:

Model 9301.....½-3 lbs. Model 9303.....2-7 lbs.
Model 9302.....1-6½ lbs. Model 9304..Up to 15 lbs.

Natural frequencies 12-15 c.p.s.
Higher stiffnesses available.
Special designs upon request.

*This multi-directional mounting, when installed as recommended, protects equipment from imposed vibration and shock emanating from any angle and permits installation and use in any position.

1955
1954
1953
1952
1951
1950
1949

ORIGINATED BY ROBINSON in 1949, the all-metal multi-directional mounting was designed to meet the radically new and different problems of ***guided missiles and jet aircraft*** requiring protection of electronic equipment from every angle against shock and vibration.

ENGINEERED AND TESTED in 1950, in the laboratory under rigorous specifications anticipating actual use, and in field tests far exceeding probable requirements, this mounting was quantity produced only when its performance had been demonstrated.

SERVICE PROVED AND UNIVERSALLY APPLIED since 1951, Robinson multi-directional mountings are now preferred for practically all military and commercial aircraft and in the newest of the guided missiles.

RADICALLY DIFFERENT from all other shock and vibration control mountings, this Robinson mount furnishes unique performance because of the inherently damped resilient cushions of patented Met-L-Flex, exclusively Robinson. No auxiliary damping means is required or used. Met-L-Flex is unaffected by attitude, extremes of temperature, aging, or the presence of oil, dust or dirt.

WHEREVER UNFAILING PERFORMANCE of equipment under maximum environmental difficulties is required, ***only Robinson*** multi-directional mountings will meet the difficulties involved.

If your need is for complete multi-directional protection of airborne electronic equipment and the assurance of its optimum performance, call on Robinson.

Canadian Distributor: **AVIATION ELECTRIC LTD., Montreal and Vancouver**

SEND FOR BOOKLET No. 900 "A New Concept in Vibration and Shock Control for Airborne Electronic Equipment."

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Vibration Control Engineers
AIRBORNE DIVISION

WEST COAST ENGINEERING OFFICE—Complete engineering design and test service. 3006 Wilshire Blvd., Santa Monica, California.

DOW CORNING *first in* SILICONES

Silicone News

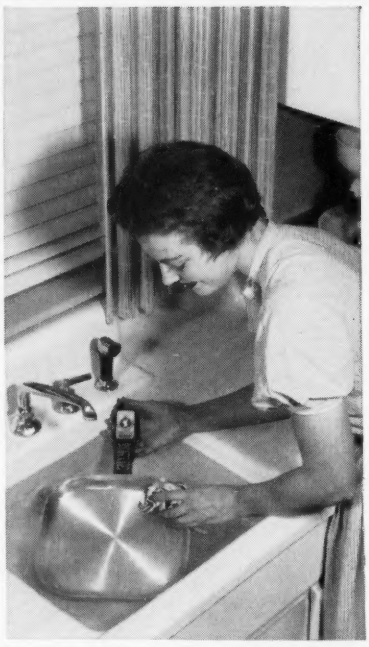
FOR DESIGN ENGINEERS

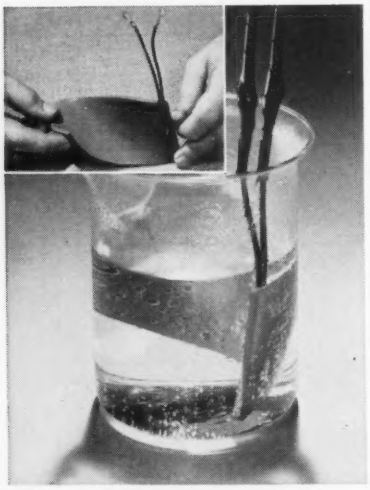
SUNBEAM "FRYPAN": CASE HISTORY OF AN ADVANCED DESIGN MADE PRACTICAL BY DOW CORNING SILICONES

Ingenious design and resourceful use of materials is reflected in the Sunbeam Automatic Frypan, an attractive and original new household appliance, which combines the appeal of a built-in source of controlled heat with the convenience of easy, thorough washability.

These ideal features were made practical through use of Dow Corning silicones. The completely enclosed lead and thermocouple wiring, for instance, is insulated with Silastic, the Dow Corning silicone rubber. Silicone-glass sleeving is also slipped over the wires to assure maximum dependability at operating temperatures in the range of 450 F. And the terminal block to which they are connected is a heat resistant silicone-glass laminate.

Although the Frypan may be almost totally immersed in water, the electrical connections at the base remain dry and easily accessible inside a terminal box sealed with molded Silastic. Extensive research and testing, including several thousand actual immersions, have proved that this gasket maintains a watertight seal even after prolonged exposure to temperatures in the range of 450 F. *No. 42*





Silastic Insulates, Protects Flexible Woven Heater Pad

Proof of the effectiveness of Silastic* encapsulation is found in the performance of this 115-volt flexible heater woven and insulated by the Haddam Manufacturing Co., Haddam, Connecticut, for a classified aircraft use. The combined thermal stability and conductivity of Silastic is so great that the heater will operate indefinitely at temperatures high enough to boil the water in which it is totally submerged. *No. 43*

*T.M. REG. U.S. PAT. OFF.

Silicone Fluid Improves Dashpot Timing Device

The nitrogen impact fishing jar developed by Houston Oil Field Materials, Inc., presents a new approach to the problem of loosening tools jammed in the depths of oil wells. On impact, old style jars shake and strain derricks and pipe strings. The new Homco unit eliminates wear and tear on equipment by concentrating all its 208 ton kick inside the jar attached to the jammed tool.

Another valuable feature of the new Homco jar is regulated impact time. By means of a unique dashpot timing device containing Dow Corning 200 Fluid, the hammer blow can be delayed while the jar is moved into a new postition. By varying the quantity and viscosity of the silicone fluid, the impact time may be varied from a few seconds to half an hour.

Dow Corning 200 Fluid was selected as the dashpot oil after tests proved it to be the most heat-stable fluid available. Organic oils thin out rapidly when subjected to well temperatures and to the heat generated by successive impact blows. But Dow Corning 200 Fluid with its relatively flat viscosity-temperature slope, thins only slightly even after 10 to 15 hours' continuous operation. This change is so slight that it is more than compensated for by expansion of the metal parts and fittings. *No. 44*

Silicone products most widely used are indexed by type of application, in the 1955 Reference Guide to Dow Corning Silicone Products. A brief but comprehensive 8-page summary is given of the properties and applications. With increasing effort devoted to product improvement and cost reduction, such a reference guide to this remarkably stable group of engineering materials becomes increasingly important to design, production and maintenance engineers. *No. 45*

"What's a Silicone?" is the title of a 32 page booklet which answers that often asked question in semi-technical terms. Indexed and illustrated, this booklet has earned an international reputation as the most interesting and informative description of silicones ever published. *No. 46*

Design Edition 11

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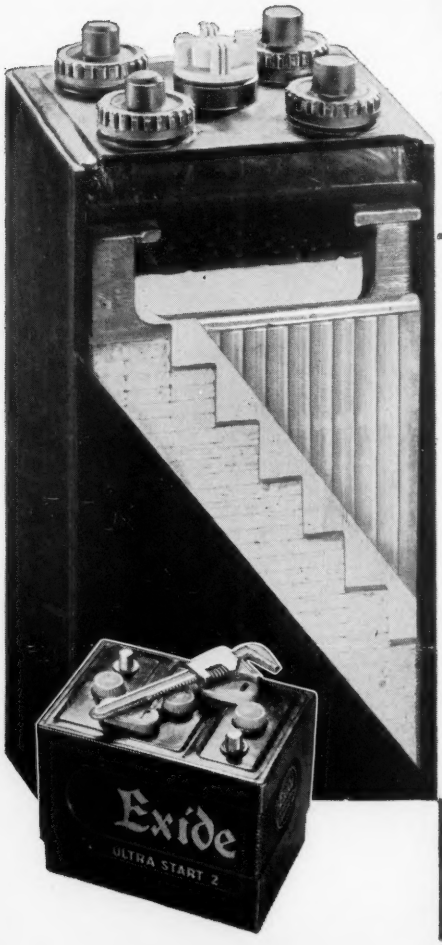
Problems solved-with

polythene

Modern Industry uses polythene's many properties... to improve product efficiency and life... reduce cost and weight.

Flexible polythene spring liners used between car spring leaves are made by Ontario Steel Products Company Limited, reduce wear, noise and vibration. The polythene strips act as a dry lubricant—result: improved efficiency, problems solved.



This battery now has 20% more capacity and life. Non-corroding polythene tubes and sealing bars reduce "sediment space", allow larger plates with greater capacity. Polythene terminal caps guard against accidental "shorting".

Polythene is a tough, light, flexible material which has an unusual number of outstanding physical and chemical characteristics. It is moisture-proof, corrosion resistant, non-toxic and chemically inert. Polythene remains flexible and strong even at sub-zero temperatures and has excellent dielectric properties. It is used in industry for such widely divergent products as flexible pipe, packing rings, carboys, electrical insulation and many other items.

Consider polythene in relation to *your* problems—it may be the key to increased sales, reduced costs, simplified production. For further information or technical assistance, write Canadian Industries (1954) Limited, P.O. Box 10, Montreal.

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SERVING CANADIANS THROUGH CHEMISTRY

plastics

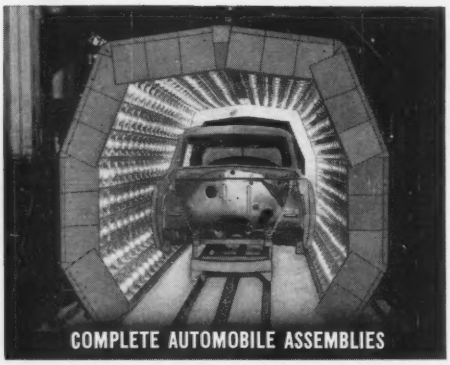
SUPPLIERS OF PLASTIC RAW MATERIALS

FOSTORIA Infra-Red

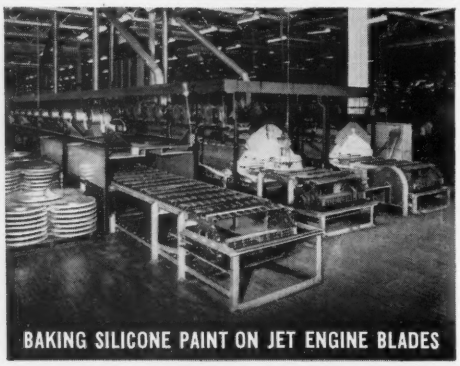
the Universal Tool for Industrial Paint Processing

Infra-Red IS FAST

Infra-Red IS VERSATILE



COMPLETE AUTOMOBILE ASSEMBLIES



BAKING SILICONE PAINT ON JET ENGINE BLADES

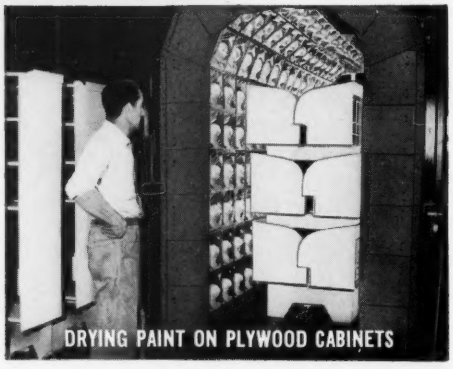
PAINT BAKING — CREAM SEPARATORS

PAINT ON MASONITE PANELS

Infra-Red IS ECONOMICAL

- Direct heat action of infra-red rays prevents costly heat-up period and maintains heat during shut-downs.
- Successfully applied to synthetic enamels, lacquers, varnishes, japans, asphalt coatings, oxide and aluminum primers and most of the new plastic coatings.
- Fostoria equipment uses specular gold-plated reflecting surfaces, the most efficient reflector of Infra-Red rays. Gold plating on undercoatings of nickel and copper give a highly durable and easily maintained reflecting surface.

Infra-Red IS SPACE SAVING



DRYING PAINT ON PLYWOOD CABINETS

Northern Electric

COMPANY LIMITED

44 BRANCHES THROUGHOUT CANADA

4154-3

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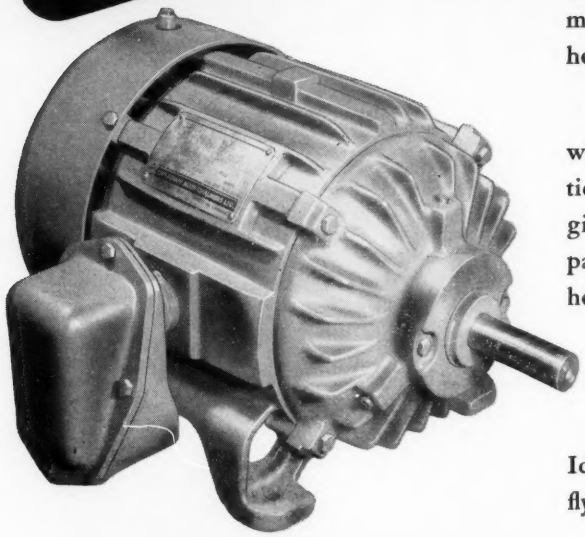

Totally Enclosed Fan-Cooled (shown) and Explosion-Proof motors carried in stock in wide range of sizes for immediate delivery.

Whether your requirements call for the Explosion-Proof or the Totally Enclosed Fan Cooled motor, you'll find the A-C Rib Type cooling system cuts maintenance costs to a new low. Because when the fan blows cooling air over exposed ribs, it also blows dirt and dust away. Materials that may adhere to the surface can be removed quickly, easily with an air hose or by wiping.

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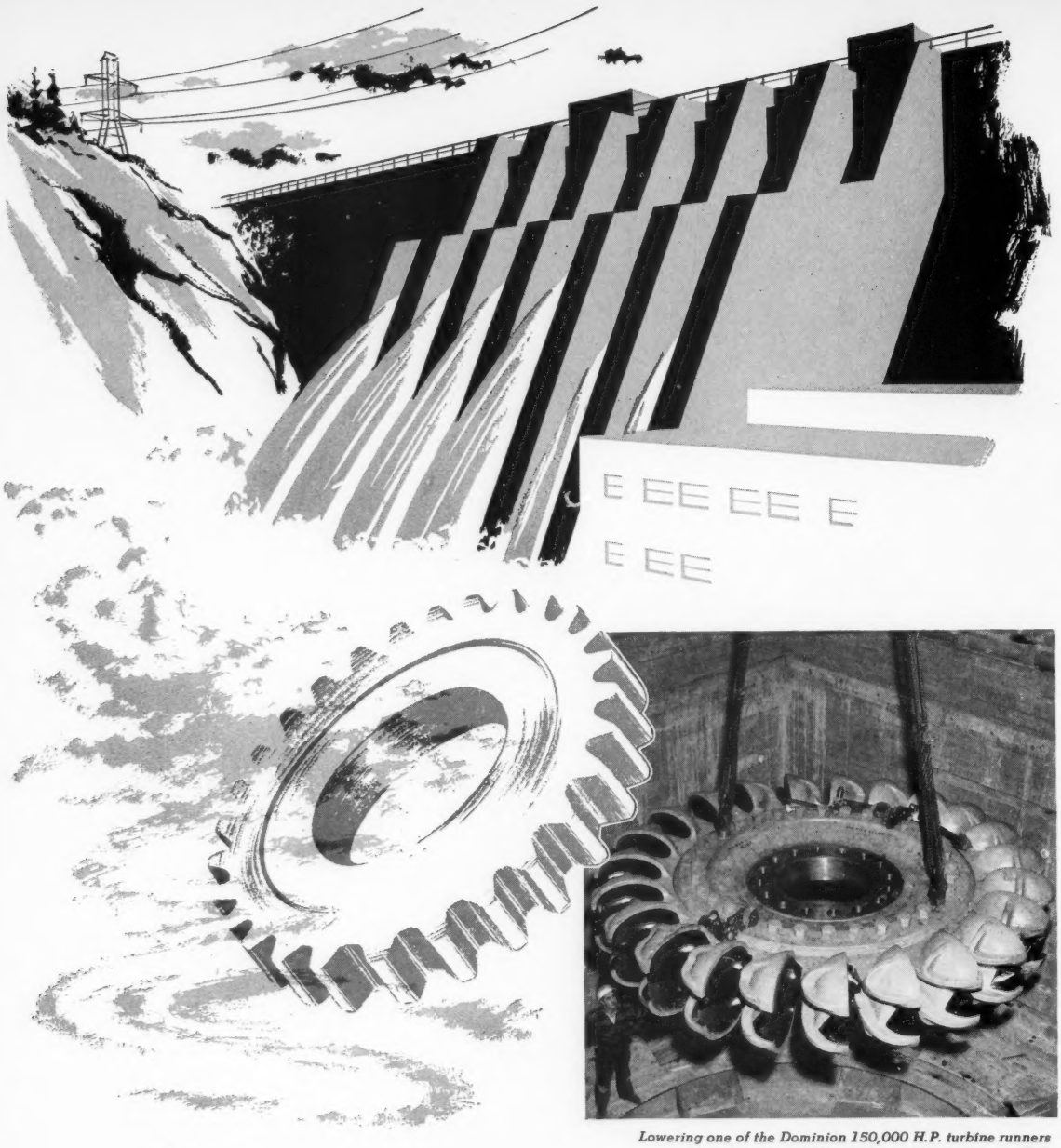

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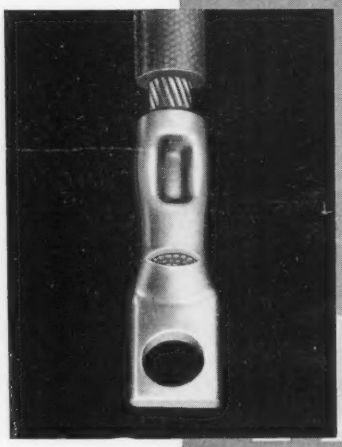
Contact requirements for inert gas filled thyratrons and rectifiers are among the most severe to be found anywhere in industry. Faulty pin-and-socket contacts are often the cause of tube failure.

About 8 years ago, Electrons, Inc. designed a 16 ampere tube with bracket mounting and flexible leads ending in Hylug connections. Performance proved so dependable that Hylug connections were adopted as standard to many types of rectifiers and thyratrons — including special thyratrons developed for military aircraft applications.

Out of the many thousands of such tubes now in service, *only 3 instances of tube failure* due to contact resistance in the filament lead have come to the attention of the manufacturer and those were obviously caused by careless tightening of lead nuts.



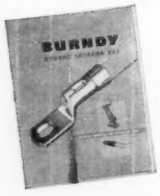
Hylug connections are superior because:

1 Instead of 4 pounds or less contact pressure, Hylugs easily maintain pressure of many hundred pounds.

2 Mechanical shock or vibration, which causes tube to deflect slightly, does not affect contact surfaces.

3 Radiation surface and air circulation between cathode and contact reduces danger of contact oxidation. Tube runs appreciably cooler.

4 No corrosion problem.



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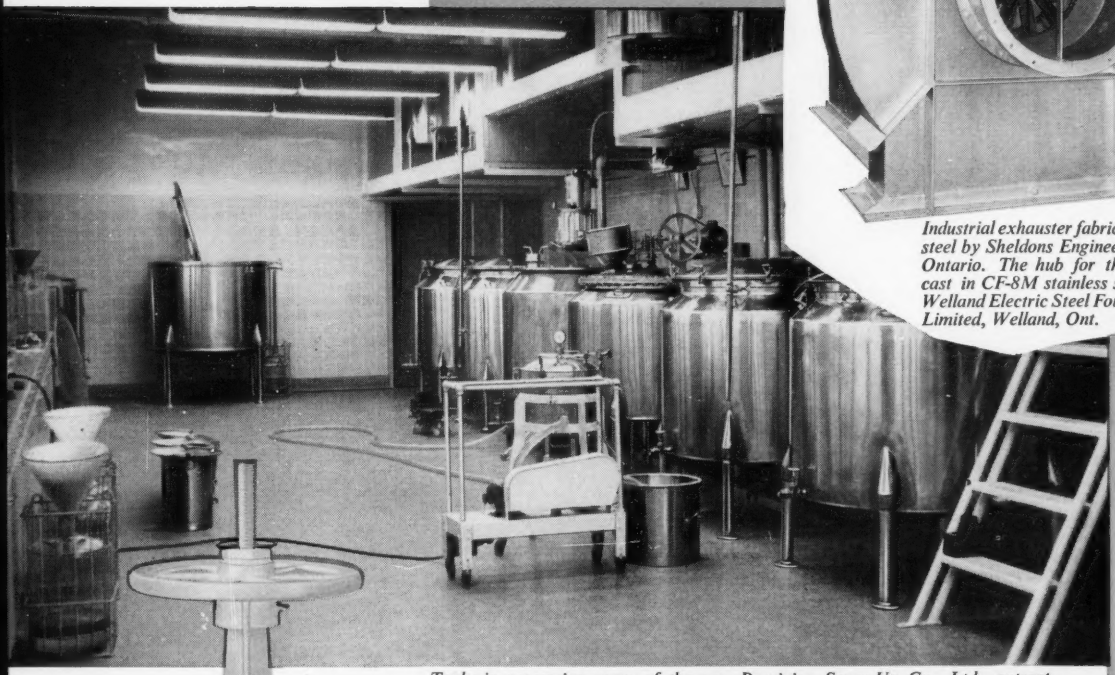
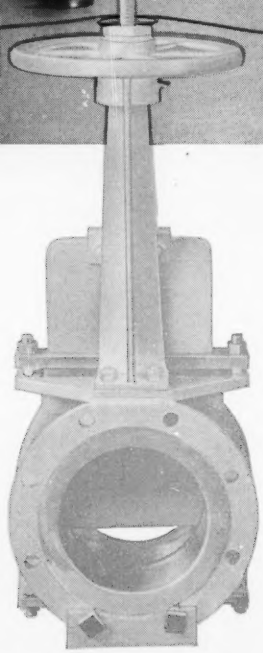
Industrial exhauster fabricated in stainless steel by Sheldons Engineering Ltd., Galt, Ontario. The hub for the impeller was cast in CF-8M stainless steel by Welland Electric Steel Foundry, Limited, Welland, Ont.



Tanks in processing room of the new Dominion Seven-Up Co., Ltd., extract plant in Toronto, fabricated by Toronto Coppersmithing Co. Ltd. Stainless steel containing nickel is used exclusively throughout.



Type 316 stainless steel valve designed to operate in pulp mills in conjunction with either wood-stave pipe or conventional alloy stock lines . . . fabricated by Ellett Copper & Brass Co., Limited, Vancouver.

LONG-LIFE SERVICE AND PRODUCT PURITY

The excellent corrosion resistance of nickel-containing stainless steel accounts for its wide acceptance in many process industries. Because of its high tensile strength, lightweight equipment can be fabricated which performs dependably under severe conditions. Its ability to withstand corrosive attacks aids in the manufacture of high purity products that are free from harmful discolouration and metallic contamination. Illustrated are a number of applications where chromium-nickel stainless steel is providing outstanding performance.

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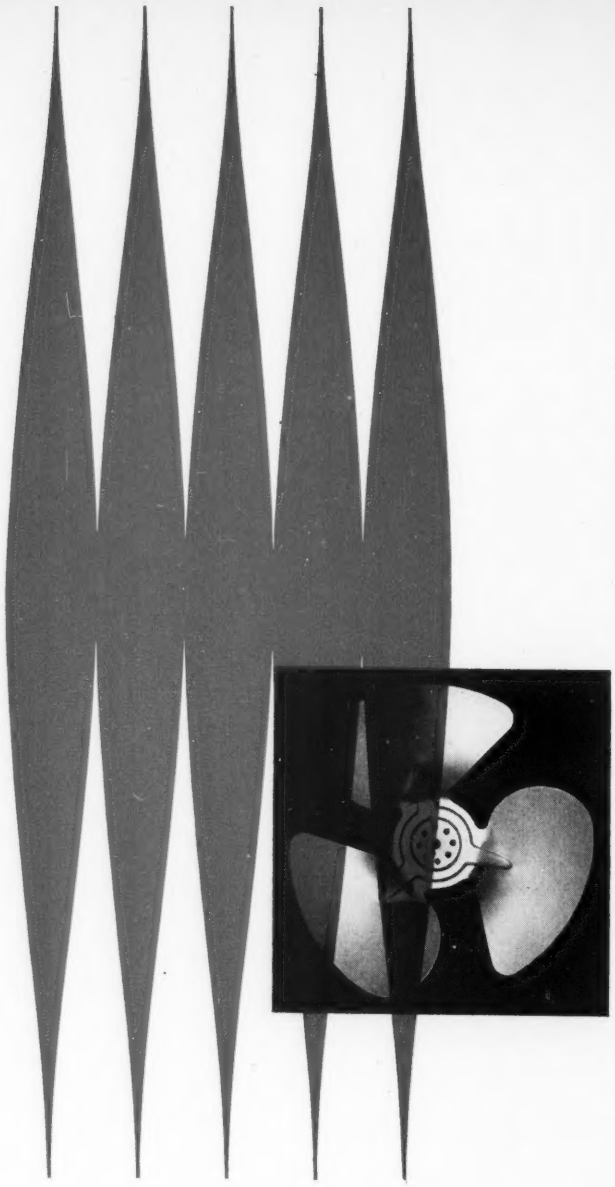

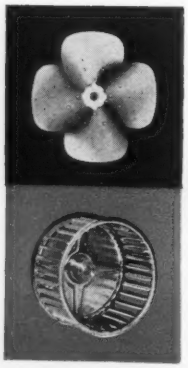

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VIP's

Important people who are in the news

SOME EXECUTIVE changes are fast following the annual meeting of the International Nickel Co. of Canada's directors.

Ralph D. Parker, already president of an Inco prospecting subsidiary, the Canadian Nickel Co., has become a vice-president. He will continue to run the affairs of Canadian Nickel—which are busy ones. "We are prospecting clean across the Dominion," he told a DESIGN ENGINEERING reporter. But now he adds the new responsibilities and broader power of high rank in the parent company.

He is no stranger to Inco. Starting in 1928, he was superintendent of the Creighton mine, then Frood mine, then became superintendent of mines. In 1935, he became general superintendent of the Mining and Smelting Division and eight years later was appointed an assistant vice-president.

Accountant **Walter A. McCadden,** Inco's assistant comptroller since 1949 has been elected comptroller. He follows **Cameron R. Whitelorne** who is now retiring.

McCadden started his career with Inco in 1935 as a tax accountant. During the last seven years he has taken three large leaps toward the top. In 1948 he went up to become assistant to the comptroller; in 1949 was made assistant comptroller. Now he carries the heavyweight responsibilities of comptroller.

Two new assistant vice-presidents have also been appointed, **Frederic Benard** and **G. Alan Harcourt.** Benard has been with the company since 1939 (since 1945 he has been general manager of Canadian operations) and Harcourt, research engineer and physicist, has been an Inco employee since 1937.

A fifth promotion makes **Walter O. Hardacre,** who joined the company in 1953, assistant works auditor.

One of Inco's business policies has been well upheld by the new appointments. Unlike some companies, Inco believes in finding its executives from within. A look at the list of the latest promotions proves that the policy is put to work.

• • •

THE DIRECTORS of the Canadian General Electric Co. met on June 8 to appoint a new president. Looking south toward the giant General Electric Co., they chose 47-year-old **James Goss,** a deep south (Arkansas) American who was then chief of GE's modern Louisville plant. He is now installed at the Canadian company's head office in Toronto.

At a time when Canada is laboring for industrial independence, the decision to import an American for one of the biggest jobs this country offers had its hazards. But during the few short weeks that the new president has used to make himself known to his staff and customers, company officials have seen enough to feel sure that the right decision was made.

"His impact has been terrific," said one. "I think it comes mostly from his frank approach—it is most refreshing! And besides this he is absorbing himself in the Canadian scene at an astonishing rate. Believe me there has been no bad feeling anywhere."

The frankness which is warming so many Canadian hearts is not the usual

Unassuming James Goss of CGE

type. James Goss is no glad-hander. His manner is quiet, unassuming—and although he is the company's chief executive officer, he has installed himself in a down-the-hall office which is small sized and modestly equipped.

Among his first moves with CGE was to ask all head office employees to meet him. They came, 100 at a time, to hear the new chief ask for their acceptance. Then, at 10.30 one evening, he came back to the office to see the night maintenance staff and office cleaners. Already James Goss is much more than a name to all ranks on the company's 13,500 staff.

"He reminds you," said one of those who met him, "of a tightly knit end on a football line. He has medium height with a good build and he moves about quickly."

Engineers believe that their executive importance in industry is growing. The appointment of James Goss gives strength to this belief—he is a graduate of Arkansas University who joined GE in 1931 as a student engineer.

Outside his business life he is a family man (wife and two children), a golfer and an antique furniture lover. He is looking now for a suitable Toronto home and lives for the moment comfortably, but alone, in a downtown hotel.

The president takes up his new responsibilities at a time when industry is already watching General Electric policy with more than usual interest. The company has believed in decentralization since it began business 60 years ago. But a new effort to decentralize more wholeheartedly is now going on. Vice-presidents are being moved away from head office complete with technical and business staffs to run their own autonomous out-of-town plants. James Goss believes that a company should "disperse its executive talent." After 24 years with the company he has had time to assess this policy with care. It is thought that his keen support for the long-tried principle which helped bring American General Electric its present power and good name is one of the reasons behind his appointment to the top executive position in the Canadian company.

• • •

A LONG-TERM employee of the one-time Dominion Oxygen Co. (now Linde Air Products), has been named chief engineer of the company. He is **Robert J. Anderson,** B.A.Sc., P.Eng., a graduate of the University of Toronto, who joined Dominion Oxygen in 1931. Chief Engineer Anderson brings much experience of industrial gases to his new post. He has held a number of supervisory jobs, especially in Engineering Service, where he has been responsible for process selling and promotion.

A member of the American Society of Metals, American Welding Society, Engineering Institute of Canada and Association of Professional Engineers of Ontario, Anderson also acts on the committees of Canadian Standards Association, Compressed Gas Association and International Acetylene Association.

Taking over his former position of Manager, engineering service, is **John W. Ross,** graduate of the University of Toronto (1941) with a degree in mechanical engineering. He has been employed in the company for over 10 years. He, too, is a members of the ASM, EIC, and the Association of Professional Engineers.

David S. Lloyd, president, explains that the new appointments which follow the change of name two months ago are necessary because of the broad expansion of Linde's business and industrial service. Primarily the moves will improve the engineering aid to Linde product users.

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For further information on the new Life-Line A Motor contact your local Westinghouse office or Canadian Westinghouse Company distributor.

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Putting strain gauges to work on this complex tapered flange joint, saved many hours of careful calculating.

Put Strain Gauges to Work in Design

They cut the risk of calculation-error in stresses

Measuring with a strain gauge saves you time and gives reliable results

Here's how you can introduce and apply these gauges

It is unimpressive to look at, but the strain gauge is an important tool

By W. C. LEITH, M.A.Sc.
DOMINION ENGINEERING WORKS LTD.

STRAIN DOES NOT always behave the way calculation says it should. A length of thin wire (about .001 in. diameter) crimped back and forth into a grid can be made to measure strain with great precision. In doing so, it often comes up with surprising results.

This is the simple strain gauge. Unimpressive to look at or to describe it is an important design tool.

The grid is cemented to a paper carrier, stuck onto the part under test and hooked up to a Wheatstone bridge. If the part distorts under stress, the grid distorts with it, and its electrical resistance changes. When a current is passed it causes unbalance in the bridge and a reading can be taken from a galvanometer or oscillogram which shows the strain.

Gauges with one wire grid are used to measure the strain in one direction only.

Or, Rosette strain gauges with several wire grids at specified angular relationships can be used to find the magnitude and direction of principal strains.

When the length of a conductor is increased or decreased, the amount of change in resistance in relation to the change in length is a measure of the strain-sensitivity of the conductor. For strain gauges, the end loops of wire in the grid are relatively inactive (except for transverse strains) and so reduce the strain-sensitivity of the straight wire. The actual strain-sensitivity factor K is called the "gauge factor" for that grid and is specified on each package of strain gauges.

$$K = \frac{\Delta R/R}{\Delta L/L} = \frac{\text{unit change in resistance}}{\text{unit change in length}}$$

Where K = strain-sensitivity factor, R = initial resistance (ohms), L = initial length (inches), ΔR = change in resistance (ohms), and ΔL = change in length (inches).

The selection of the proper type of strain gauge for specific uses is always influenced by these factors:

- The maximum temperature at the gauge.
- The area available for the gauge.
- The endurance conditions during the test.
- The choice of cement to limit creep.

For temporary testing, nitrocellulose cement is suitable for the average run of accuracy but for permanent installations where accurate calibration is required, phenolic-resin cement, cured in definite cycles, is better preferred.

Strain gauges are usually connected in a Wheatstone bridge circuit where small variations in resistance can be measured accurately (see picture). An unbalance results in the bridge when the resistance of the active gauge is changed by strain and the difference in voltage across the output terminals of the bridge becomes a measure of the strain. Since the wire used in strain gauges is temperature sensitive, in addition to being strain sensitive, a dummy gauge is mounted on an unstressed part of the same material as compensation.

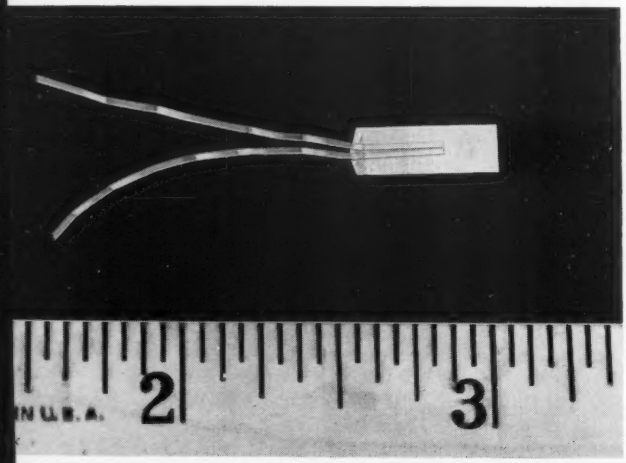
Measure static, dynamic strain

Both static and dynamic strains can be measured by electronic instruments which allow the indicating or recording gear to be located some distance from the machine being tested.

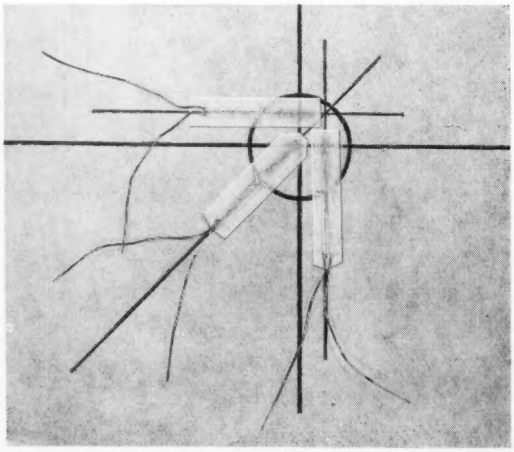
Strain can be read in either direction, but each strain reading must be taken from the initial datum level of that particular gauge. The basic circuit is a Wheatstone bridge and the zero method of balancing is used to ensure accurate results.

For studying dynamic strain, a cathode-ray oscilloscope can be used to indicate variations, or an oscillograph can be used to record data showing the magnitude and the strain level.

For frequencies up to 100 cps, the pen recorder is very popular since it gives a permanent record, has a wide range of sensitivity and has a built-in calibration circuit. An oscillograph needs an amplifier to supply the necessary torque to the pen, when measuring the tiny electrical impulses that occur in strain gauge circuits. A carrier-type amplifier is used for strain



A strain gauge — a little larger than life size. The two wires take current variations away for measuring.



Each gauge reads in one direction only. For complex measurements, gauges should be arranged as a rosette.

gauge circuits, and direction as well as magnitude can be read from the chart. Connections are brought out to a four-arm bridge, and from one to four active gauges may be used. With less than four active gauges, precision registers are inserted to complete the Wheatstone bridge.

The modern impulse turbine, with its multi-jet configuration and its governor controlled servomotors, is a far cry from the "water wheels" of ancient China. The use of elbow-type wye branches in modern impulse turbines permits a very simple arrangement which is suitable for vertical multi-jet installations at large power ratings.

In 1946 an agreement was made between Dominion Engineering Works and the well-known French firm of Neyrpic, to collaborate on the design of impulse turbines and spherical valves. By combining the experience of the two organizations and supplementing this with a steady program of research and development, much progress has been made. The efficiency of the wye branch has been verified by hydraulic testing, carried out in conjunction with the single jet testing of the runner and four jet testing of the complete model turbine.

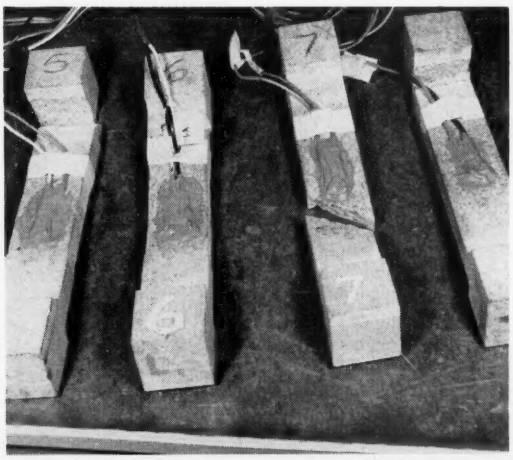
The mechanical design of the wye branch gives not only strength to withstand the internal pressure, but also rigidity to hold the nozzle alignment.

The design of the wye branch came after much theoretical study and model testing. Strain gauge tests were useful for reducing the casting weight of parts to keep pace with the modern competitive market. The acceptance test used was 150% of normal operating pressure which gave designers a chance to note the performance of the manifold during its most severe static test. The stress contours on the outside surface of a typical wye branch, during the test are shown (see picture).

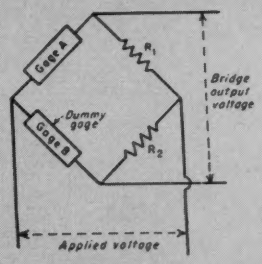
The design of bolted flange joints with compressible sheet gaskets has been simplified generally by the methods outlined in the ASME code.

But this method applies to circular flanges under internal pressure with gaskets entirely within the bolts and with the outer rim of the flanges not touching under the applied loading. The method cannot be directly applied to one type of joint used widely in machinery under high pressure, such as impulse turbine manifolds.

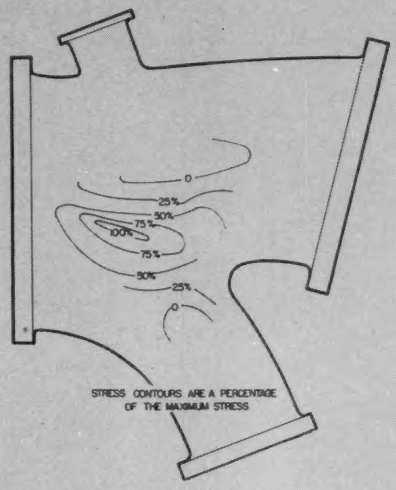
(continued)



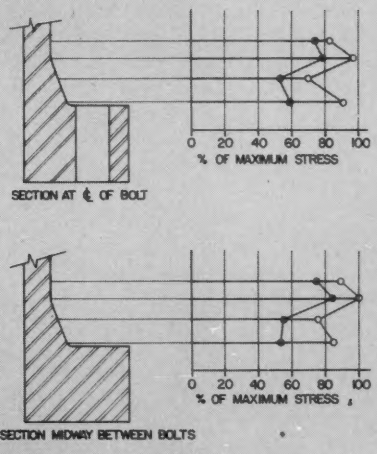
What is the modulus of elasticity (in tension) of a granite bar? Strain gauges give the answer quickly.



Wheatstone bridge reacts to unbalance to give oscilloscope strain readings.



Contours (like those on a map) trace stress as percentages of the maximum.



Strain gauges proved lower stresses in this flange followed prestressed bolts.

In this joint, the flange has no raised bearing surface and neoprene O ring is seated in a V groove on one face. The O ring seals tighter as the internal pressure increases as compared with the flat gasket in a standard pipe joint which becomes looser as the internal pressure increases.

Extensive tests on these joints conducted for the Hydraulic Division of the Dominion Engineering Works have given much experimental data which shows the advantage of pre-stressing alloy steel bolts to about half their yield strength, so as to get a balanced stress distribution. Additional prestress in the bolts can reduce the maximum stress in a tapered flange by about 15% at the test pressure (see picture).

A simple but rough method of flange design, given by Bach, assumes the flange to be a cantilever with its fixed end at the pipe wall. The bending stresses obtained are radial stresses diminishing toward the outer edge of the flange ring. The axial bending stress between the wall and the flange ring, the circumferential stress in the ring and the influence of the pipe wall are usually neglected in Bach's method.

A complete analysis of the relationship between the flange ring, the pipe wall and the bolt tension can be obtained by applying the theory of the bending and deflection of circular plates.

Research is continuous

Although there is a continuous research program devoted to Dominion power cranes and shovels, a recent added feature was the installation of a dynamometer for testing horizontal reverse shaft clutches. This dynamometer was specially designed to accommodate any reverse shaft assembly from the production line.

Reversing shaft or swing clutches are designed for the full engine torque. Swing clutches must however, be designed with sufficient heat dissipation capacity, to withstand the high speed duty cycles of present-day working schedules. The swing clutch must accelerate and decelerate the total revolving inertia load of the cab, the boom and the load. The total kinetic energy of the revolving mass is supplied and then withdrawn during the slippage cycles, and this energy is dissipated as heat by the clutch. The drum temperature increases until the heat dissipation balances the energy flow from the friction linings. The clutch assembly is so designed that the maximum drum temperature during a specified duty cycle is compatible with the characteristics of the friction lining.

Preliminary tests on the dynamometer have been confined to an evaluation of clutch lining behaviour, such as torque-temperature curves during specified duty cycles.

The dynamometer consists of a 100 hp variable speed d-c motor and a gear reduction unit which drives the horizontal reverse shaft clutch. The friction clutch mechanism in turn drives two flywheels through a speed increasing unit. The flywheels are laminated discs so that the inertia load can be adjusted to suit the inertia of a specific machine. The clutches are applied by air chambers worked by a manual control valve or an automatic dual circuit timer. The motor runs continuously at a fixed speed and the friction clutch mechanism controls the direction of rotation of the output shaft. The length of the reversing cycle for each clutch is set on the timer which has a range from zero to 60 seconds.

Even though the dynamometer is valuable for comparing different friction linings during controlled duty cycles, the most promising feature is the ability to correlate new clutch designs to the results of experimental testing. In addition, the testing of production clutches and the study of the effects of clutch adjustments are important items on the testing agenda.

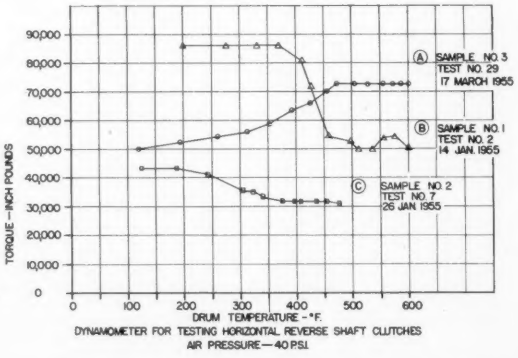
The application of instrument circuits to the moving members of the dynamometer requires the use of slip rings on the moving member. Silver slip rings and silver graphite brushes provide a suitable assembly which has been used successfully up to a peripheral speed of 33 ft. per sec. For strain gauge testing, the complete Wheatstone bridge should be mounted on the moving part so that the brush contacts are outside the bridge. To reduce the effect of variation in contact resistance, two brushes should be used, spaced 180 deg. apart on the circumference of the slip ring. A good bearing surface between the brushes and the slip ring can be obtained by wearing in the brushes.

The output torque is measured by strain gauges on the output shaft to the flywheels. Four strain gauges are mounted on a 45 deg. helix with the longitudinal axis so that any bending or axial stresses are cancelled and temperature compensation is provided. The output from the strain gauge is fed into a carrier-type ampli-

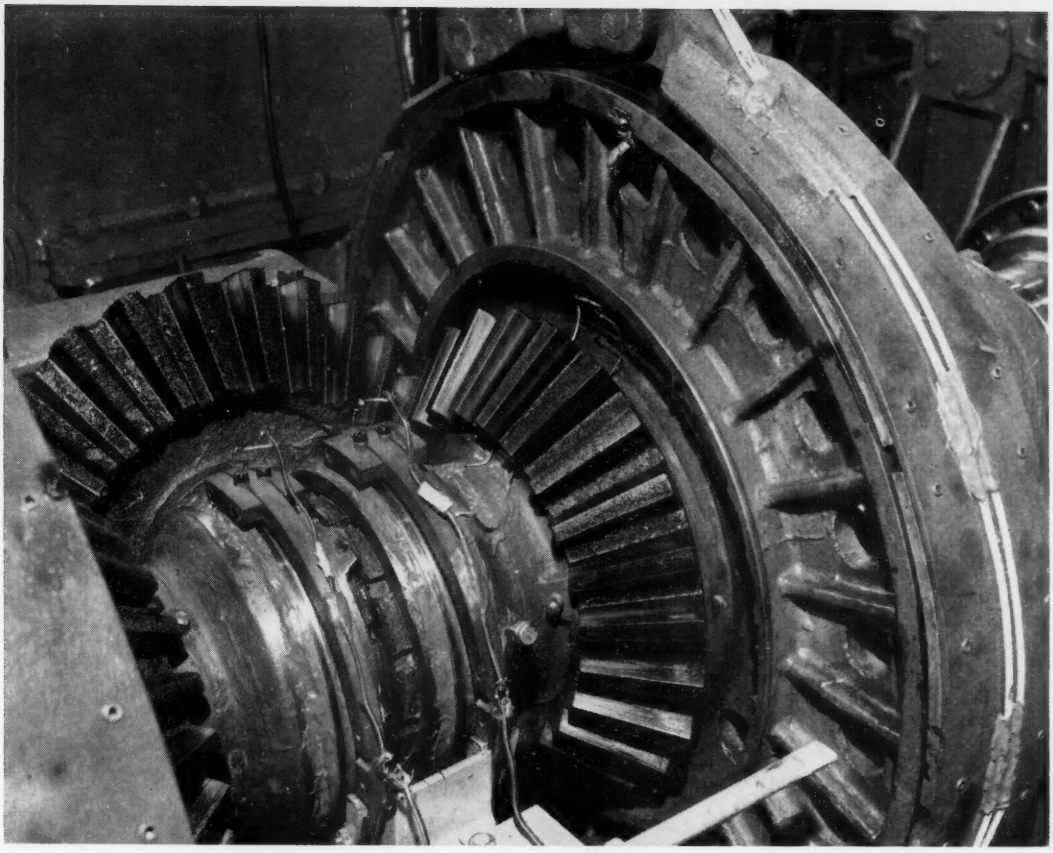
Robert Hooke began it all . . .

Stress analysis owes much to an early scientist Robert Hooke. In 1678, he found that for many materials stress is proportional to strain. But the proportionality applies to unilateral stress only. Although two dimensional stresses can be found from strain too, the stress-strain relationships are complex. Hooke's law applies to most metals and especially well to steel.

After Hooke's day, in 1856, Lord Kelvin discovered the other important contributor to modern stress analysis—the change of electrical resistance that goes with strain and which can be measured. ●



Sample No. 1 is suitable for slow working cycles, below 400 degrees F, and No. 3 much higher.



First cousin to the strain gauge is the thermo-couple for finding temperature changes. Here is one at work.

Measure rapid temperature changes by oscillograph instead of poteniometer

fier and then from here it passes to the oscillograph.

The tensions at the live and the dead ends of the clutch bands are measured by strain gauges which have to withstand the high temperatures generated by the friction. The complete bridge is mounted on the operating lever so that the brush contacts are outside the bridge. The output is taken off the slip ring assembly and then fed into the carrier amplifier and the oscillograph.

The temperature of the two reversing drums is measured by iron-constantan thermocouples embedded in the flange to within 1/16 in. of the surface at the centerline. The thermocouples are connected via the slip rings to a Brown indicator.

A thermocouple consists of two wires of dissimilar metals, connected at the ends. When the two junctions are subjected to different temperatures, an electrical potential is set up between them. This voltage is directly proportional to the temperature difference, and so a millivolt instrument placed in the circuit could measure the temperature directly. The readings are, however, affected by the resistance of the lead wires.

For measuring rapid changes in temperature such as occur on the drums, the Brown potentiometer, which has a relatively slow response, can be replaced by an oscillograph. The Brush magnetic oscillograph has a variable paper speed from 5 mm per hour to 125 mm per second, and a maximum frequency response of about 100 cycles per second. A high gain d-c amplifier is used for thermocouple circuits where the maximum potential generated is about 0.010 volts.

Dominion granite rolls are used extensively in Canada as an essential part of modern high speed newsprint machines. Canadian Laurentian pink granite has a very fine structure and is particularly suited for newsprint machines. Continuous development in Dominion paper machinery is highlighted today by the added impetus of strain gauge testing. A typical example of modern testing is the determination of the modulus of elasticity of granite in tension, as shown (see picture).

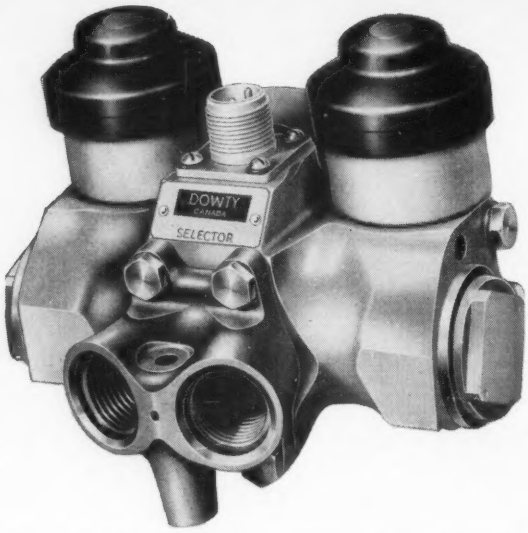
The cementing of strain gauges to granite involves several extra precautions because the grain structure is so porous. Acetone was applied liberally to the granite before the strain gauge was cemented so that the cement was absorbed into the granite to provide good bond. One disadvantage when testing granite is the insulation properties which prevent a check on the leakage across the cement film.

The even growing complexity of manufactured products seems to mean that as competition demands cheaper machines more correlation will be required between design and mechanical research. The use of bonded resistance strain gauges and the evolution of electronics has elevated the role of mechanical research to a full-fledged partner with design, and the future will reveal important results from this co-operation. ★

CF-100's Hydel Valve Canadian Brainchild

By T. M. Kemp

DOWTY EQUIPMENT OF CANADA LTD.



The high delivery valve is compact and a light-weight.

Canadian Dowty Company's suggestion resulted in hydel valve for CF-100

DURING DESIGN of the Avro CF100 Canuck all-weather fighter aircraft, a need arose for a compact, light-weight, solenoid-operated selector valve. Many types of pilot-operated solenoid valve were available from various manufacturers; but none of these had enough installational flexibility.

Up to that time, Dowty Equipment of England, had developed a number of selector valves, each more refined and simplified than its predecessor. The latest type seeing service in 1950, in the UK and in Canada, was a poppet type unit incorporating a thermal relief valve. Although this unit was suitable for banking, it was a little bulky and heavy. To reduce the weight and size, while still providing the installational flexibility wanted by the customer, various types of design were thoroughly looked into.

The Canadian Dowty Company was responsible for suggesting a valve configuration using the shear seal principle and this was finally chosen. The unit was designed and developed in the UK and christened the Hydel (high delivery) valve. It features compactness, installational flexibility, reliability, high flow capacity and low pressure drop. It has a minimum number of parts, is simple and cheap to manufacture and needs hardly any maintenance in service.

The valve is offered in fully Americanized versions incorporating O ring seals throughout and is one of the first British units to meet the US military specification for slide valves. Due to this standardization of design, the basic valve is flexible and most suitable for use with any fluid for which standard O ring seals are available. It has, in fact, become the standard electro-hydraulic selector valve in the Dowty line and is evidence of the contribution the Canadian company is making to the group's products.

The valve consists basically of a hydraulic valve electrically operated by twin solenoids. These solenoids are selectively controlled by the operator by means of a Dowty push button or lever switch. This form of electrical control enables the valve to be located remote from the control while simplifying the whole hydraulic system by eliminating much of the piping between the operator's control and the actuating jack.

Light and compact, the valve ensures rapid response and allows large fluid flows with minimum pressure drop. Its design is so flexible that several variants of the valve are available to meet different circuit requirements. Type Q1704 (illustrated here) gives a four-way, three-position selection with blind neutral. This valve can be considered as typical of the series. Other three-way, twin solenoid types are available with and without a neutral position, or with the flow to the selected service either open or closed after de-energizing. Single solenoid, two-way valves can also be supplied.

Back to the Q1704

Returning to the Q1704 valve, the sequence of operations can be followed by referring to the functional diagram. In a hydraulic circuit, the valve unit is supplied with fluid under pressure from the pump to the supply connection. The valve service ports (1) and (2) are connected to the hydraulic jack (or similar actuating device), while the return port is connected to the reservoir. With both solenoids de-energized, fluid pressure in the valve is contained within the housing of the centrally located, spring-loaded piston and the cylinders of the servo pistons. Equal pressure on the composite servo pistons holds them against stops at the inner end of the cylinders. With equal pressure applied against the outer ends of both servo pistons, the slide valve is centralized in the neutral position, blocking off service ports (1) and (2). In the event

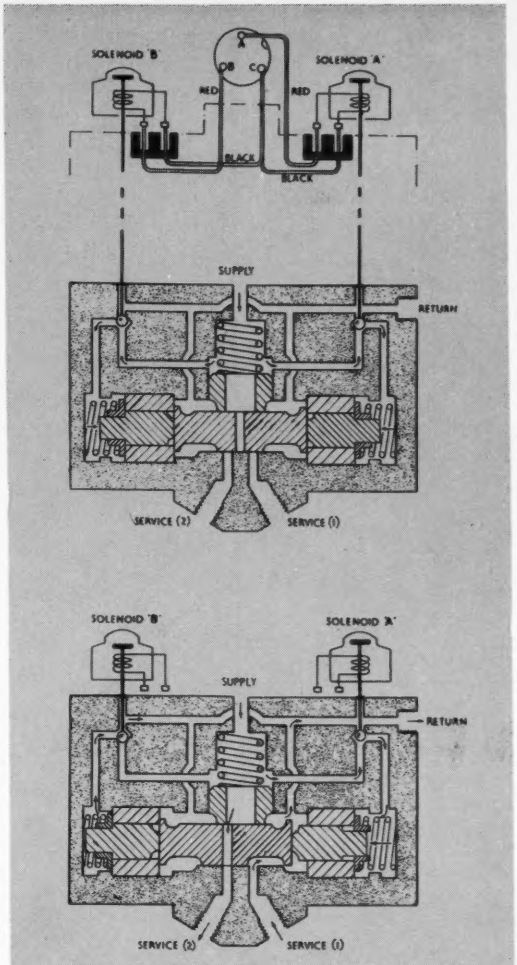
of low or insufficient pressure in the hydraulic system, compression springs, loaded against the outer ends of the servo pistons, maintain the slide valve in the neutral position and preclude selection.

The central part of the slide valve is sealed against a pressure-tight face between service ports (1) and (2). Pressure equilibrium is maintained in the valve by the pilot ball valves pressing on their upper seats, as illustrated. These pilot valves are controlled by the solenoids A and B, whose plungers act on spring loaded spindles in contact with the ball valves. When solenoid B, for example, is energized, it forces the valve off its upper seat on to the lower one and cuts off pressure to the related servo cylinder and upsets the pressure balance in the unit. In addition to cutting off pressure from the related cylinder, transference of the ball from the top to the bottom seat opens the cylinder fluid duct to return. The inner servo piston of the opposite cylinder is then free to move the slide valve unopposed against the unpressurized servo pistons. At the end of this movement, the central port of the slide valve is positioned over the service connection (2). Pump pressure and fluid flow are then in direct communication with the inlet connection of the actuator. The channels machined in the right hand side of the slide valve, now located over the service connection (1), permit free fluid flow to the return pipe line.

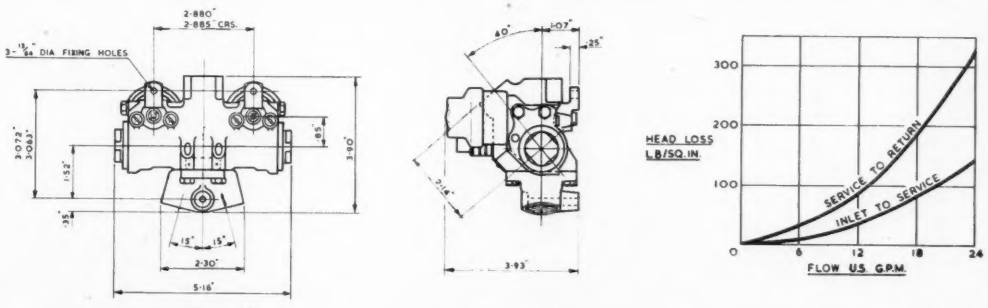
These conditions are maintained until the solenoid is de-energized and the pilot valve restores pressure equilibrium by returning to its upper seat. Operation of the right-hand solenoid A produces a similar series of actions on the counter-part valve and pistons, with the effect of directing the pressure flow through port (1) and return to the reservoir via port (2). The sequence of events is extremely rapid: selection of either service from neutral is completed in 0.12 second, while the return to neutral is performed in 0.03 second.

The solenoids are continuously rated for voltages between 28.5 and 22, with a test voltage of 16 at a temperature of 20 deg C.

Both single and twin solenoid types of "Hydel" valve are designed for hydraulic systems with operating presures up to 4,000 psi at any temperature between +70 deg C and —54 deg C. The normal flow capacity is 20 Imp gallons per minute (24 US gpm) ★



Top, the wiring scheme; middle, solenoids de energized; bottom, solenoid B energized.



Design data

Weight, 2.5 lbs.; max. working pressure, 4,400 psi; test pressure 6,600 psi; temperature range 70 to —54 deg. C; hydraulic fluid, MIL-0-5606; ports ¾ in. 16 NF 3; volts 22 to 28.5 (service); amps .4 max.; rating, continuous.

Phone & TV Via Hollow Cable Wave-Guide

Big changes to phone and TV transmissions are coming from this flexible copper tube, claim Bell engineers.

Bell lab experiments prove a new helical long distance wave-guide may carry tens of thousands of calls, TV

Soon, thousands of phone conversations and TV programs may be carried together in Bell's hose-like tube.

A WHOLLY NEW medium for transmitting television and telephone conversations over long distances has been successfully used in experiments by the Bell Telephone Laboratories.

The new idea, a long-distance waveguide, differs quite a lot from modern cable or radio relay systems: it uses hollow metallic tubes of about two in. in diameter.

It is thought that the new waveguide may someday simultaneously carry tens of thousands of cross-country telephone conversations, as well as hundreds of television programs. Top capacity for the most up-to-date coaxial cable systems is 1,860 two-way telephone conversations or 600 such telephone conversations and two TV programs simultaneously on a pair of coaxial tubes. Modern coaxial cables have eight such tubes, two of which are kept as spares.

Waveguides made of solid metal tubing—roughly like a metal water pipe—have been widely used for some time over short distances. And it would be possible to use these solid metal tubes for long distances—but only if they could run straight.

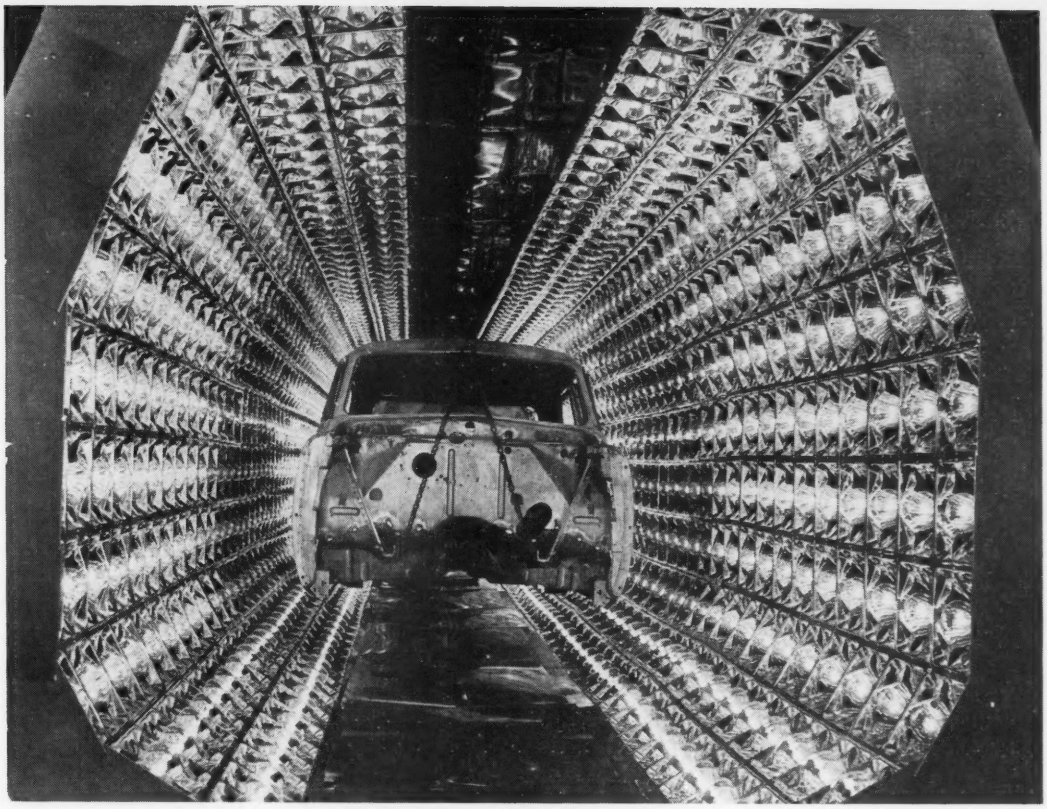
The new long-distance waveguide is a hollow tube of thin copper wire, tightly coiled like a spring under load, and wrapped inside a flexible outer coating for holding the coiled wire in place. This type need not be straight and can actually carry signals around corners.

Experiments show that the solid tube waveguide and the new coiled wire or helical waveguide can be used together in communications systems, one for short distances and the other for long ones.

Recent experiments at Bell's Holmdel, N.J. laboratory indicate that the new waveguide transmission is so promising that, when fully developed, it might join coaxial cable and radio relay as an everyday transmission medium. Engineers hope to use the new waveguide in a variety of ways. One of these might be with a heavy protective coating so that the hollow tubes are run underground.

Although this new form of transmission is still in the experimental stage, a recent long distance test was made in a copper pipe 500 ft long. Engineers bounced signals back and forth in the tube for distances of 40 miles. They calculated that in comparison, the same waves could have traveled only 12 miles in a coaxial cable with the same loss in strength.

The new transmission system operates in such a high frequency range that it has never before been put to practical use for communications. This range is, in fact, so high that engineers have as yet no name for it, although the short waves used are known as millimeter waves. The "super high" frequency range established by the Federal Communications Commission goes up to 30,000 mega- **(Continued on page 62)**



Canada's automobile plants are among the world's most modern. Here is Studebaker's (Hamilton) infra red oven.

How Infra-Red Baking Paces Industry

By ALAN R. HARPER

NORTHERN ELECTRIC COMPANY

Manufacturers are switching to the infra-red oven for greater efficiency

INDUSTRY IS FAST going over to infra-red baking ovens. And the reasons for this move are good. Radiant heat is quicker, more efficient and, in the end, more economical. And technical difficulties which helped to keep older convection systems popular have now been solved. With their disappearance radiant ovens have a clear road ahead.

Radiant heat sources transmit energy as electromagnetic rays. When the rays hit an object capable of absorbing them, they turn into heat. But convection heating, of course, is an indirect process. It depends on the atmosphere to act as a heat exchange and for high efficiency the hot air should be kept prisoner (which is only partly possible) in the oven.

The big disadvantage of convection heat methods has always been that combustion products have somehow to be eliminated. If they are not, they will deposit themselves on components passing through the oven and may do damage. To keep this effect as slight as possible, air must be allowed to escape to be replaced by new, clean air. But then away goes the heating efficiency which might otherwise be had.

Heat energy from an infra-red source (see picture) does not suffer from this waste. The product is directly heated by the lamps and being hotter than the air which surrounds it, does not absorb heat from the air. Instead it gives up a small proportion of its own heat to a narrow adjacent layer.

This heated air moves upward, carrying with it any volatiles. Its movement is controlled so that there is no deposition or appreciable drop in efficiency from the motion of cool air.

Since the early days of infra-red (in the late thirties) much progress has been made in the technique both of oven design and processing treatment. A picture here shows the interior of an early installation used for baking the paint on small aircraft bombs.

The gold-plated reflectors used in this early equipment were hexagonal in shape and every effort was made to fit successive rows of lamps, which at that

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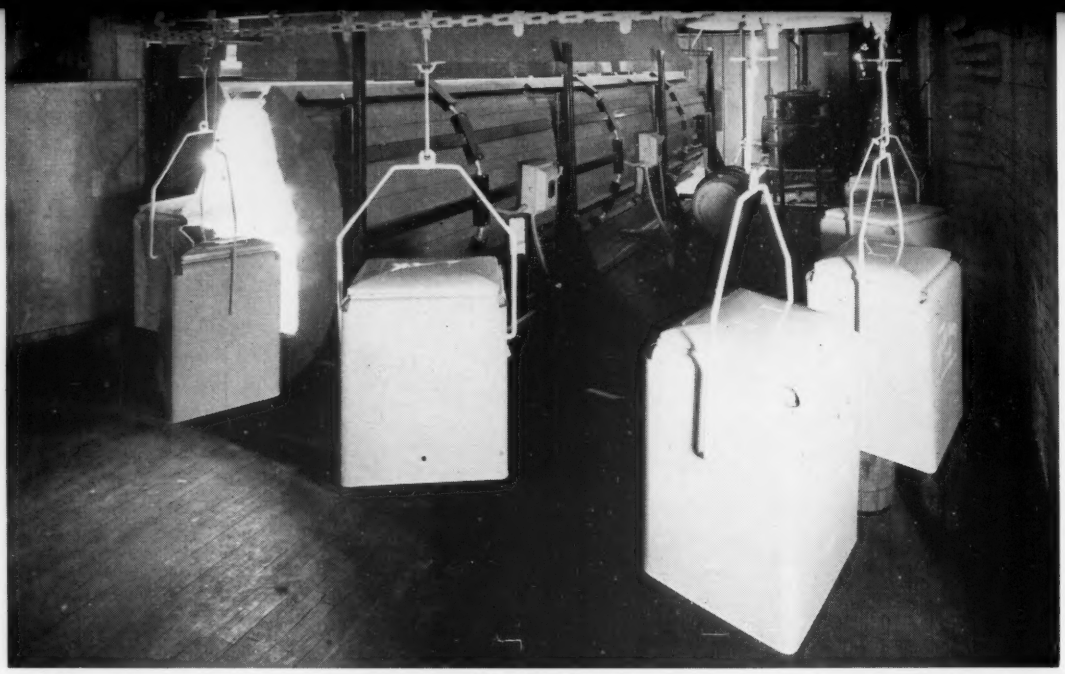


Portable refrigerators on a conveyor system are baked in five minutes in an up-to-date 22-foot Everay oven.

Infra-red baking *continued*

time had limited wattage capacity, so that they took up most of the available space. And since these early lamps were limited in capacity, very little could be done about wattage variation in the oven.

The illustrations of modern installation which accompany this article show the extent to which the design of equipment has progressed during the intervening period.

Reflectors are now square instead of hexagonal and both vertical and horizontal intervals between reflectors have been eliminated. Lamps are available in intermediate capacities from 125 watts to 1,000 watts.

When laying-out an infra-red oven, radiant heat principles must be remembered. The energy from the lamps, some of which is diverted by the enclosing reflectors, travels in a straight line toward the object being processed.

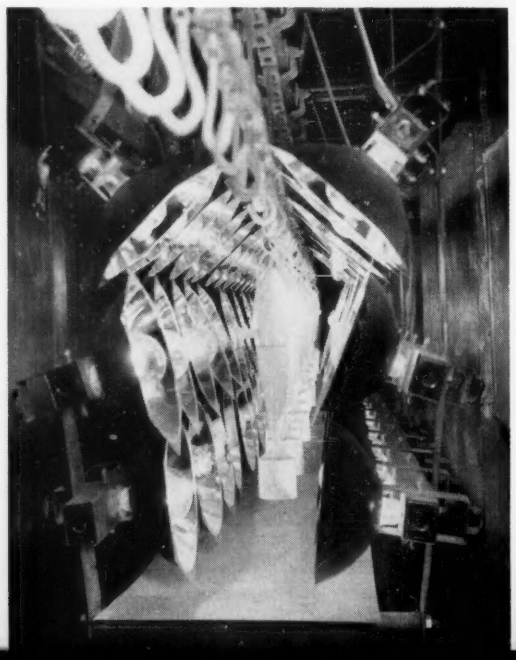
The heat-rays which do not strike the product are reflected back into the oven by the opposite side. So there is a continuous reflection process going on inside the oven, between walls and the product, with a slight drop in heat or energy with each reflection until complete absorption has taken place.

In the case of products giving off strong reflections some of the energy is re-radiated to the walls of the oven; but if these are gold-plated with strong reflections themselves, the energy immediately bounces back into the oven.

Although the exact design of an oven for any par-

This G.E. portable paint dryer is an infra-red unit used for quick drying retouched paintwork on autos.

Below, an early installation used for baking paint on small aircraft bombs. Note the primitive design of unit.



ticular purpose depends on all sorts of special needs such as size, contour and character of product, the ideal condition is for the end view of the oven to surround the product as far as possible.

Conveyor speed is fixed by the number of pieces passing through in an hour and the conveyor space needed for each piece. So the length of the oven depends on the baking time required.

Two types of oven have been developed. The first, (by the General Electric Company), is an infra-red unit used for drying retouched paintwork quickly on motor cars where small areas have been repainted after repairs, (see picture).

Tests show that knifing stopper can be dried in ten minutes and is ready for the flatting coat in an hour. Before, it had to be left overnight. The primer coat can also be dried in ten mintues. Cellulose enamel for finishing coats is dry and hard enough for use in 20 minutes per coat, although the final coats must be left overnight before polishing. In addition the quick drying does not allow moisture to condense and so prevents blooming of the finish.

The lamp gives a maximum uniform intensity over an area 1 ft. square when it is 1 ft. from the work. It can easily be moved as required and the counterbalanced arm adjusted to the correct position. Compressed air cools the lamp and prevents the concentration of inflammable vapors. A nickel-plated grille protects the lamp from damage.

A second type now in production, (by Perfection Industries, Inc.) is a new infra-red radiant gas heater.

Germany was first

Developed in Germany, the Infra Rayhead Heater has been in wide use in Europe for the past two years. It operates on any kind of gas—manufactured, natural or liquefied petroleum and can be used anywhere, indoors or out.

Types of finish vary, but the paint manufacturers usually stipulate that the product should be baked at a certain temperature for a specified time.

So it is therefore best to use heavy wattage lamps at the entrance to the oven, to raise the temperature of the product as quickly as possible.

The required temperature is usually reached after one to three minutes, depending on the mass of the component.

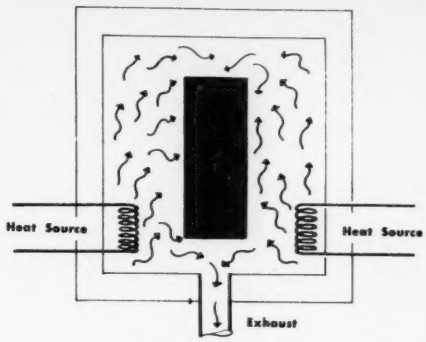
At this point in the oven, therefore, lamp wattage can generally be reduced, and a constant temperature maintained throughout the length of the oven.

Reference has already been made to the advantage of radiant heat over more conventional processes. This advantage is particularly emphasized by the use of clear infra-red lamps with the addition of gold reflection.

A chart, (see picture) showing the relative efficiency of gold and other metallic surfaces is revealing in this connection. The gold reflecting surface may be applied over intervening coats of copper and nickel on a steel base. This way the gold is stopped from amalgamating with the base metal and long reflector life is assured.

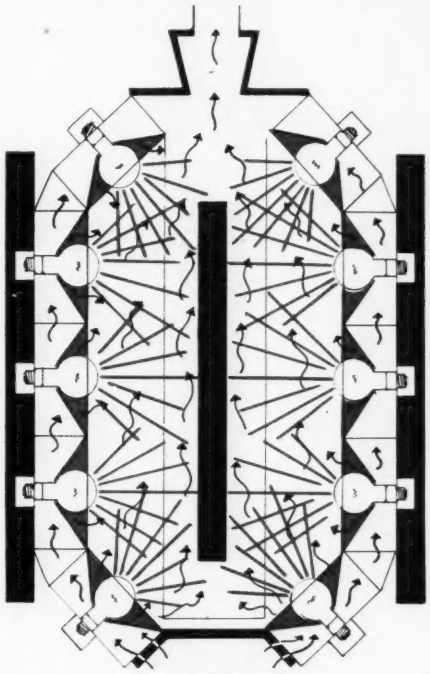
Periodical cleaning of infra-red ovens is essential if high efficiency is to be maintained. But the efficiency of ovens equipped with gold-plated reflectors will not drop below an oven using reflector lamps without reflecting surfaces, even if they are poorly maintained.

A study of working installations shows the cost of regular cleaning **(Continued on page 62)**



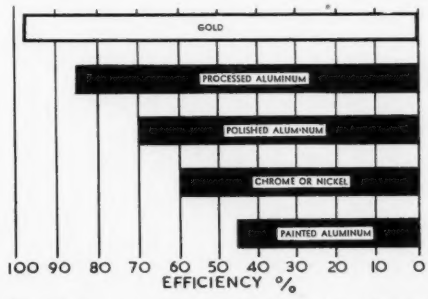
The old way . . .

In the convection oven, heat is transferred from lamp to air, which, in turn, heats product.

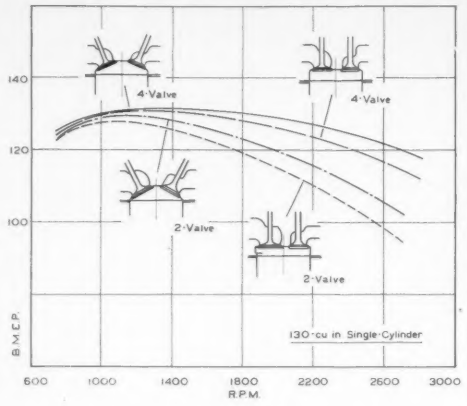


. . . and the new

Product receives direct rays from lamp in this infra-red oven at the Studebaker shop.



Graph shows reflective efficiency of gold and other metals in the infra-red baking process.



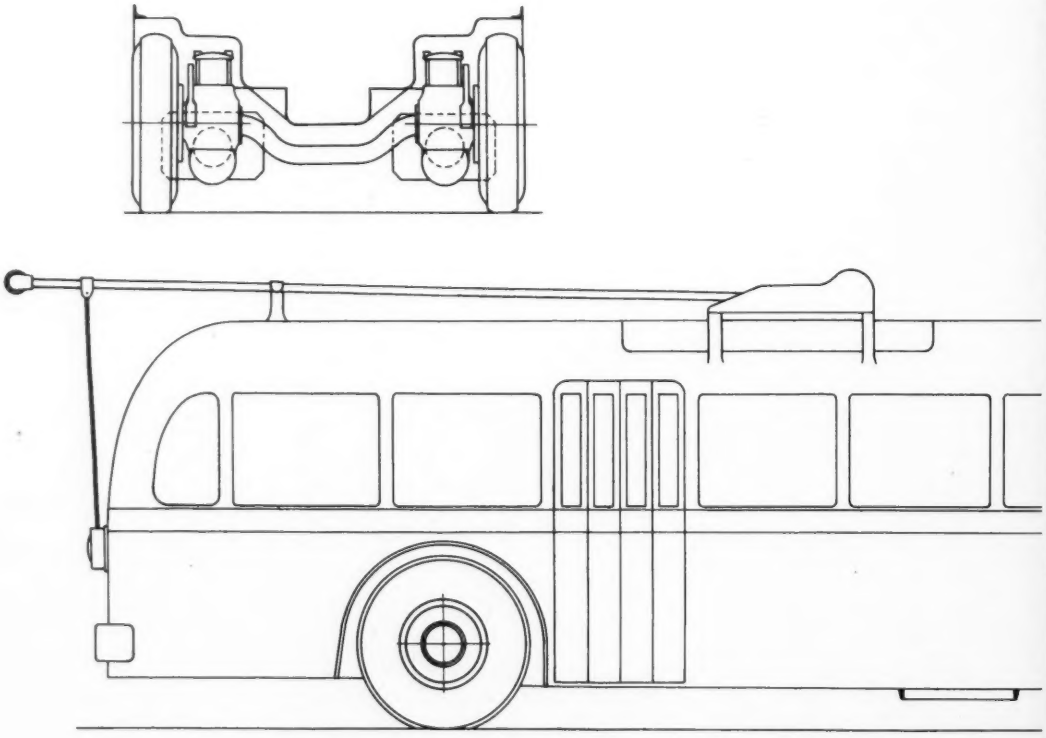
one idea at a time

This simple but effective chart gives only one engine performance factor to keep curves clear.

You Should Sell

Your ideas will go farther if you offer them to management forcefully and concisely. The following article tells about drawings, progress reports, that bolster your design abilities

BY PERCIVAL E. BIGGAR
ENGINEERING CONSULTANT



This illustration of a trolley-bus was drafted to show low floor features,

Management on coming Products, Ideas

IS YOUR ENGINEERING DEPARTMENT doing a first-class job of selling its services? It is important that it should. Good selling can make the difference between an Engineering Department that potters along, tolerated as an unavoidable expense, and one that is the source of new ideas, new products, one that is vital to the health and earning power of the whole enterprise.

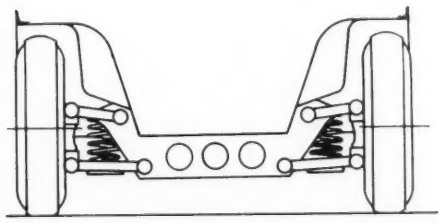
A department may have what seem sound ideas and worthwhile projects, but, unless it can convince management that these are worth pursuing, it cannot hope for the time and money necessary for their development. While good management is always aware in a general way of what is going on in engineering, there is often a special occasion when engineering can lay its wares on the table.

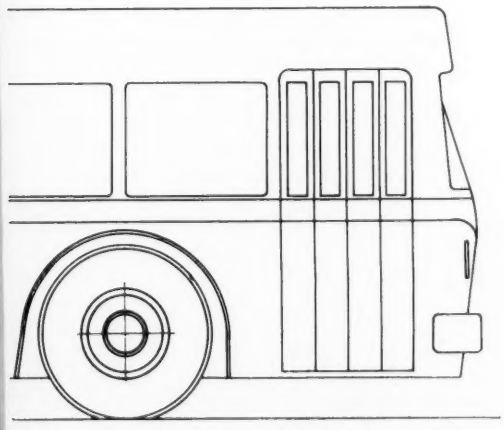
This engineering presentation is a more or less formal report to management on all the creative work in progress or proposed by engineering. In this report, which is usually given verbally, engineering outlines the progress of all current projects and tests, brings forward its new ideas for consideration and presents its program of new models to be released to production. With each project is an estimate of the time and money needed to complete its development.

The frequency of these presentations varies. In one company of which the writer has first-hand knowledge, the largest builder of buses and heavy trucks in the U. K., there was one a month. Once a year a presentation was devoted entirely to deciding what new models would be exhibited at the annual commercial vehicle show in London or Glasgow and to arranging for their delivery in good time.

In another company, in the U. S. a presentation is made annually to introduce each new model program of a division to corporation management. Since this management is not familiar with the division's products as a result of day-to-day contact, the presentation, in this instance, is somewhat formal and more in the nature of a technical sales conference.

Whichever arrangement is followed, it presents an opportunity for the engineering department to show what it can do and what it can contribute toward the reputation and success of the company.





other details were left out.

The first selling rule

The first rule of good selling is to understand the customer's point of view. Management will not wish to be concerned with engineering problems and engineering must be prepared to state its conclusions briefly and clearly—what it hopes to accomplish and how long and how much money it will require to reach a given objective.

Consider first how to present a new device or invention, next how to prepare a progress report on a project still under development, and finally to prepare for the release of a new model to production.

In the case of a new device, all that exists, perhaps, is a rough sketch or two, possibly a scale layout to see if the thing will go together. What is needed is a drawing that will be both attractive and intelligible to management. This drawing may be quite simple, as long as it shows clearly how the new device differs from one that is already familiar. It is made up to go on a sheet about 18 by 28 in., is traced on cloth and several Ozalid prints made. One of these prints is very lightly tinted in watercolor, to show up the various parts. Tinting must be very light and rather than overdo it, a safe way is to run a narrow band of color, perhaps one-eighth inch wide, along the inner side of the boundary of each part or assembly. Work up several prints if necessary until a pleasing effect has been obtained.

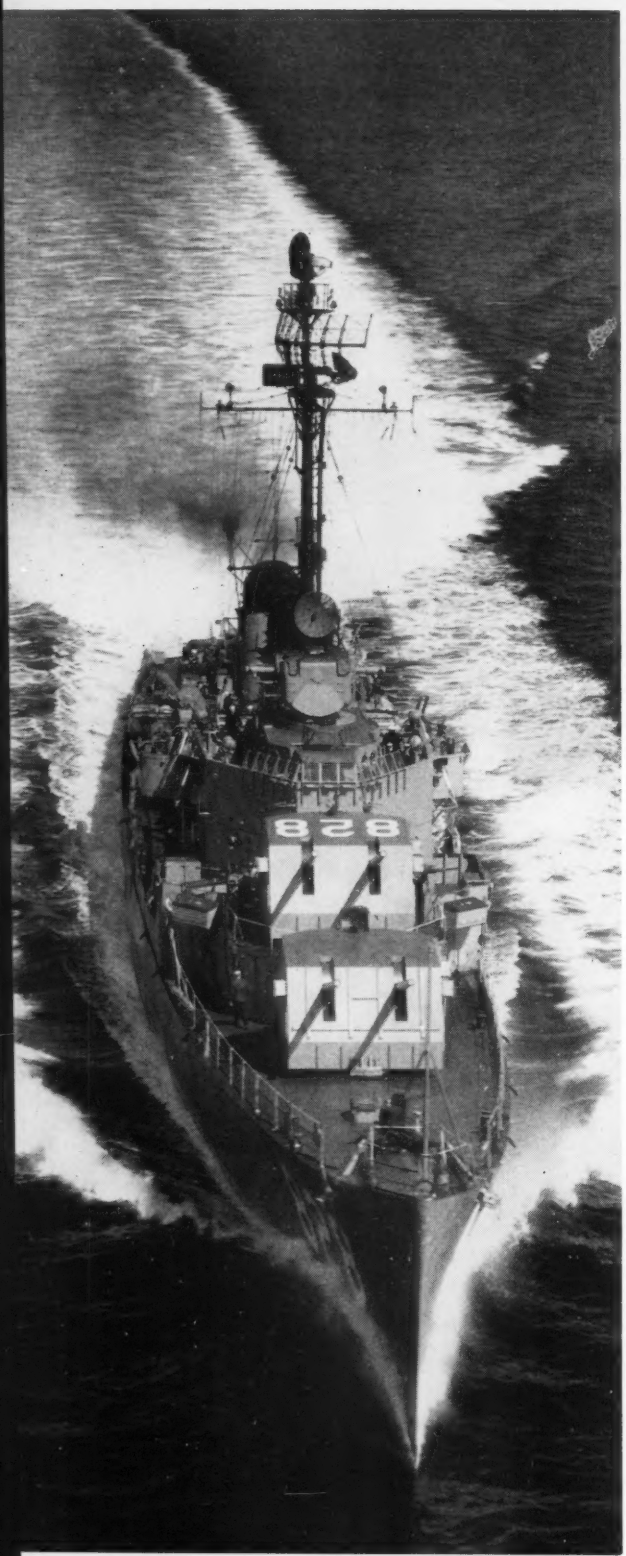
Look at the presentation sketch of this kind which shows a low-floor trolley-bus. Note that everything is left out that does not help to show how a low floor can be obtained and the over-all effect of this on the appearance of the vehicle.

The reason for making the drawing rather large is to ensure that it will be looked at. If too small, it may be put in a stack **(Continued on page 46)**

A Ship of the Future

By DENNIS BROOKS

In service fifteen years ahead of time this super-design destroyer is product of U. S. navy, who redesigned the vessel from a wartime destroyer to give her a greater radius, more speed, less weight



Spreading a broad wake during sea trials off Boston, new USS Timmerman reveals terrific speed and control.

The U. S. Navy has produced a destroyer fully 15 years ahead of her time. This is the new USS Timmerman.

The decision to re-examine the entire design of destroyers was made in 1946. War experience showed the need for a ship with greater cruising radius, higher speed and better seakeeping characteristics. And greater demands on space and weight from new electronic equipment and weapons made it necessary to cut-back on machinery weight.

Improvements in the design of ships stopped during the war years to allow for greatly increased production and so standardization of design. It was felt that to make improvements the whole design concept should be re-examined. As a result, it was decided to build a destroyer carrying machinery of less weight and taking up less space than the normal 60,000 shp plant but still providing 100,000 shp.

The Timmerman was one of the DD-692 Class destroyers, partially completed at a private shipbuilding yard when the war ended. Construction came to an end but was resumed in 1946 when the Navy contracted for the ship to be completed as an advanced design.

	DD-692 Long Hull	Timmerman-AG 152
Standard displacement, tons ...	2,425	2,425
Total shp	60,000	100,000
Weight of machinery, tons ..	938.7	835.8
Weight of machinery, lb per shp	35.0	18.8
Lb per shp in percentage of DD-692 lb per shp	100	54
Weight of electrical plant tons	137.6	61.5
Weight of electrical plant in percentage of DD-692 electrical plant	100	45

Already Given Sea Trials in Tests by U.S.

Timmerman's standard displacement remains the same as the original design but shp is increased 40 per cent.

At present the ship is undergoing trials which are not yet complete. But much knowledge has already been gained and this article summarizes it from reports made by Commander D. G. Phillips, U.S.N.I.

For a 100,000 shp propulsion unit to replace a 60,000 shp plant, special thought had to be given to: reduction of design margins; reduction in factors of safety to make them consistent; uses of higher rotative speeds, voltage and frequency; and better materials.

Except for shockproofness, the general specifications for destroyers were scrapped. Contractors were told to make new developments or designs provided they led to advances in economy, space or weight. Guarantees were required only for workmanship and material, so that neither the shipbuilder nor the sub-contractor was held responsible for legitimate failure.

Many design studies were made to form a basis for the selection of the most promising steam conditions, electrical plant and characteristics of components and systems to be used. Leading manufacturers of boilers, propulsion plant machinery, electrical equipment and other auxiliaries were called upon to design, develop and supply the necessary machinery.

	Ferritic System (875 psi)	Austenitic System (2,000 psi)
Carbon	0.14	0.08
Manganese	0.33-0.57	2.00
Phosphorus	0.025	0.03
Sulphur	0.025	0.03
Silicon	0.45	0.75
Nickel	...	9.00-13.00
Chromium	2.00-2.50	17.00-20.00
Molybdenum	0.90-1.10	...
Columbium	...	Stabilized not more than 0.8
Tensile Strength	60,000	75,000
Yield Point	25,000	30,000

Sometimes duplicate orders were placed with different manufacturers so that only the best possible equipment was used. In the case of electric motors, for example, orders were issued for the production of development units and these were allowed to run until manufacturers acquired the necessary know-how. During the early part of this period, an acute sense of competition grew between sub-contractors; and they were encouraged to break away from tradition, go out into the blue, for truly radical and advanced designs.

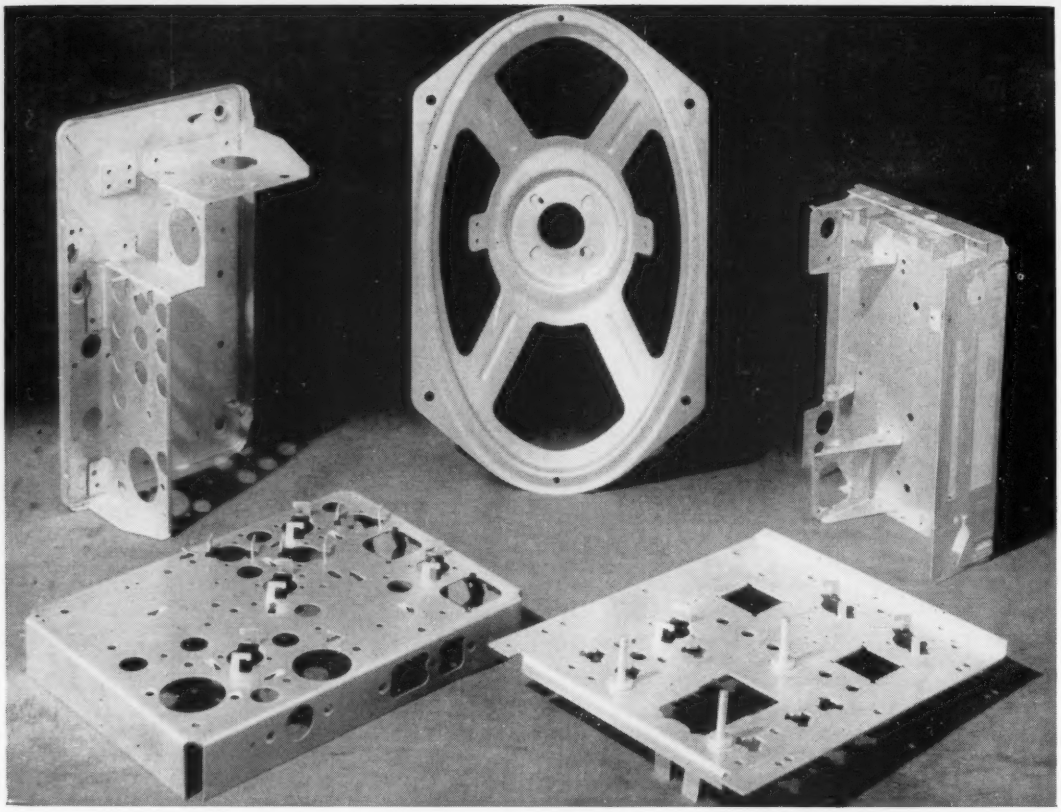
Of course, a high degree of co-operation was essential between the U. S. Bureau of Ships, the design agent, the supervisor of shipbuilding and the various sub-contractors. And the sub-contractors deserve special credit for their willingness to take risks, for farsightedness and perseverance in staying with a concept which made them vulnerable to criticism if the result failed.

Since this was to be an experimental ship it was not considered inconsistent to use different steam conditions for the two propeller shafts, so that comparisions could be made. For the starboard plant it was decided to use steam at 875 psi and 1,050 deg F, and for the port plant, 2,000 psi and 1,050 deg F.

The design of the main steam piping system held many problems of steam pressure and temperature, thermal shock and weight. At the start there was no information available on piping systems using temperatures of 1,050 deg F and subjected to the number of complete heating and cooling cycles met in shipboard plants. It was estimated that, during the life of the Timmerman, the main steam system would be subjected to a maximum of 4,000 heating and cooling cycles. It was believed that stresses higher than in the ASME code could be used to obtain thinner pipe walls. This would reduce thermal shock, increase flexibility and decrease weight.

Big metallurgical problems arose when attempts were made to reduce the weight of the main steam system; many materials had to be considered. Thermal shock tests were carried out on both austenitic and ferritic piping of 6 in. nominal diameter with 0.718 in. and 0.432 in. wall thicknesses. The piping materials finally installed have been listed (see table).

To make the high-pressure, **(Continued on page 54)**



These electroplated steel parts were given a typical application of tin-zinc alloy coating 0.0003 in. thick.

Protective Coatings Fight Corrosion

By R. R. ROGERS, P.Eng.
DEPARTMENT OF MINES

Many metals help resist corrosion besides giving products a better look

THERE ARE ABOUT 70 metals known to industry. Eleven of these are specially important in protective coatings work—for having coatings applied to them as well as for use as protectives themselves. (Table 1).

The second Table shows a convenient breakdown of metal coatings. The two main groups are natural and artificial coatings. Artificial coatings are subdivided into metallic and non-metallic, each of which is further subdivided as shown.

A coating is applied to a metal usually to help its resistance to corrosion or wear, or to give it better appearance. Frequently a coating is useful for more than one of these purposes. The resistance of a coating to corrosion depends on the nature of the basic metal, coating material and environment; also on factors such as coating adherence, thickness, porosity and number of coatings.

Most coated metals are exposed to the atmosphere when in service. The rate of corrosion in this environment usually increases with the temperature and humidity; also with the concentration of materials such as soot, carbon dioxide, sulphur dioxide and hydrogen sulphide at the surface of the metal. And the salt present in a marine atmosphere has an accelerating effect.

If the coated metal is immersed in a liquid during service, the corrosion rate depends on such things as liquid composition (including oxygen concentration), temperature, type of immersion (partial or total), nature and amount of solid material suspended in the liquid, and the speed at which the liquid moves across the surface of the metal.

Of course, a coating which is satisfactory in some environments may be most unsatisfactory in others. But in any case satisfactory coating adherence cannot be had unless the surface of the basis metal has been pre-treated to remove grease, oil, rust and mill scale. Processes such as blasting, solvent or alkali cleaning, and pickling are useful for this purpose.

If cost is to be kept low a coating should be as thin as possible. However, if it is too thin it will not provide the required amount of resistance to corrosion and wear. The porosity is likely to decrease as the thickness and number of coatings are increased.

Some metals, such as chromium and aluminum, and some alloys, like the stainless steels, appear to remain uncorroded when exposed to the ordinary

atmosphere. This is because they automatically become covered with a thin, transparent protective coating under such conditions. This film ordinarily is produced by the action of oxygen on the metal and after it has attained a certain thickness, it acts as a barrier. In doing so it prevents further oxygen from reaching the metal. The natural film which is formed on aluminum in this way is said to be in the order of 0.000002 in. thick; but it is very hard, adherent and durable.

All the 11 metals listed above except magnesium can be used as metallic coatings on other metals. They may be applied by the methods summarized in Table 3.

● **Hot dipping.** The article to be coated is dipped into a molten bath of the coating metal. This can be tin, aluminum, lead (in the form of an alloy with tin) or zinc.

The art of coating cast iron or wrought iron with tin—called tinning—by this method was known before AD 25.

● **Cementation.** By this method the article to be coated is heated while surrounded with particles of the coating metal.

● **Electroplating.** The article to be coated by electroplating is covered by a film of metal which is electrolytically produced from an aqueous solution surrounding the article.

A number of alloy coatings can be produced by electroplating. Of these, mention may be made of copper-zinc, copper-tin, tin-nickel, tin-zinc and nickel-cobalt alloys.

The hardness of typical electroplated metals, as reported by one investigator, is given in Table 4.

● **Spraying.** By the spray method fine particles of the molten metal impinge on the article to be coated.

TABLE 1: LIST OF METALS REFERRED TO

IRON ALUMINUM ZINC MAGNESIUM

These four and their alloys

usually need an artificial protective coating

CADMIUM CHROMIUM COPPER

LEAD NICKEL SILVER TIN

All but magnesium

can be used as coating on other materials

Operator gives tube aluminized coating at RCA plant Marion, Indiana, with the Stokes 22-unit installation.

Some alloys also may be easily applied by spraying.

● **Vacuum coating.** The coating metal can be heated in a vacuum, the resulting vapor condensed as a film on the article to be coated. Films of this type are ordinarily extremely thin.

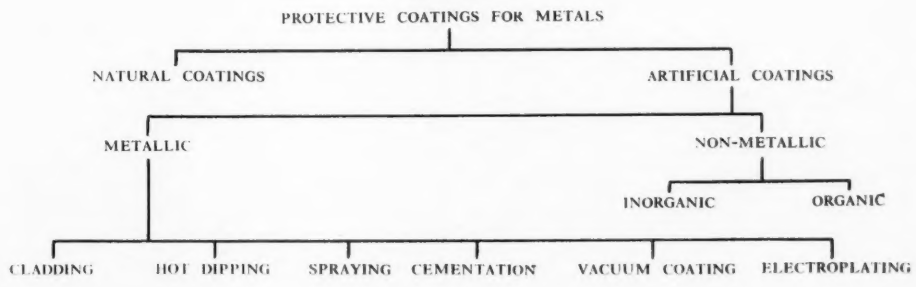
At the present time aluminum is the only metal that has been successfully used for this process commercially.

Although not mentioned in the Table, it is sometimes possible to deposit a metallic coating by means of a chemical reaction which takes place at the surface of the article to be coated. Nickel can be deposited this way and the resulting film is claimed to be adherent, hard, non-porous and of uniform thickness.

Each of these processes has certain advantages. For instance, the coating thickness can be most readily controlled in the electroplating process; the spraying process is the only one which can be used in the field, due to the light weight and mobility of the equipment required. And so on.

Coating of the less active metals, such as copper and tin, protect a basis metal such as iron from corrosion by isolating it from its environment. But, no protection is given at pores and cracks in the coating.

TABLE 2



Protective Coatings *continued*

On the other hand, coatings of the more active metals, such as zinc, give protection at pores, and so on, as well as isolating the basis metal from its surroundings.

The metallic coatings produced by the above processes ordinarily are very thin. Cladding processes have been developed by which quite thick layers of metal may be applied to other metals. For instance aluminum alloy 24S may be clad with pure aluminum, and ordinary low carbon steel may be clad with stainless steel, nickel or other metal.

Inorganic coatings can be used on any of the common basis metals under consideration. Some give good protection to the basis metal when used by themselves, and others are used particularly because they make an excellent base for paint.

Perhaps the most important inorganic coatings now used on iron consist of insoluble phosphates. These are dense and much thicker than the natural films already discussed. They adhere well to the basis metal and may be used as a good base for paint.

Vitreous enamels also are readily produced on certain ferrous materials. Although comparatively expensive, they are quite hard, resist atmospheric and certain other types of corrosion particularly well—and offer a wide range of colors. Their brittleness is sometimes a handicap. Small articles were enamelled by the Egyptians at least four hundred years before Christ. So this one is an old art.

Although magnesium is normally protected by a natural film when exposed to the ordinary atmosphere, it is advisable to protect the metal with some type of artificial coating when used under more highly corrosive conditions or when **(Continued on page 62)**

TABLE 3

HOW TEN IMPORTANT METALS ARE APPLIED

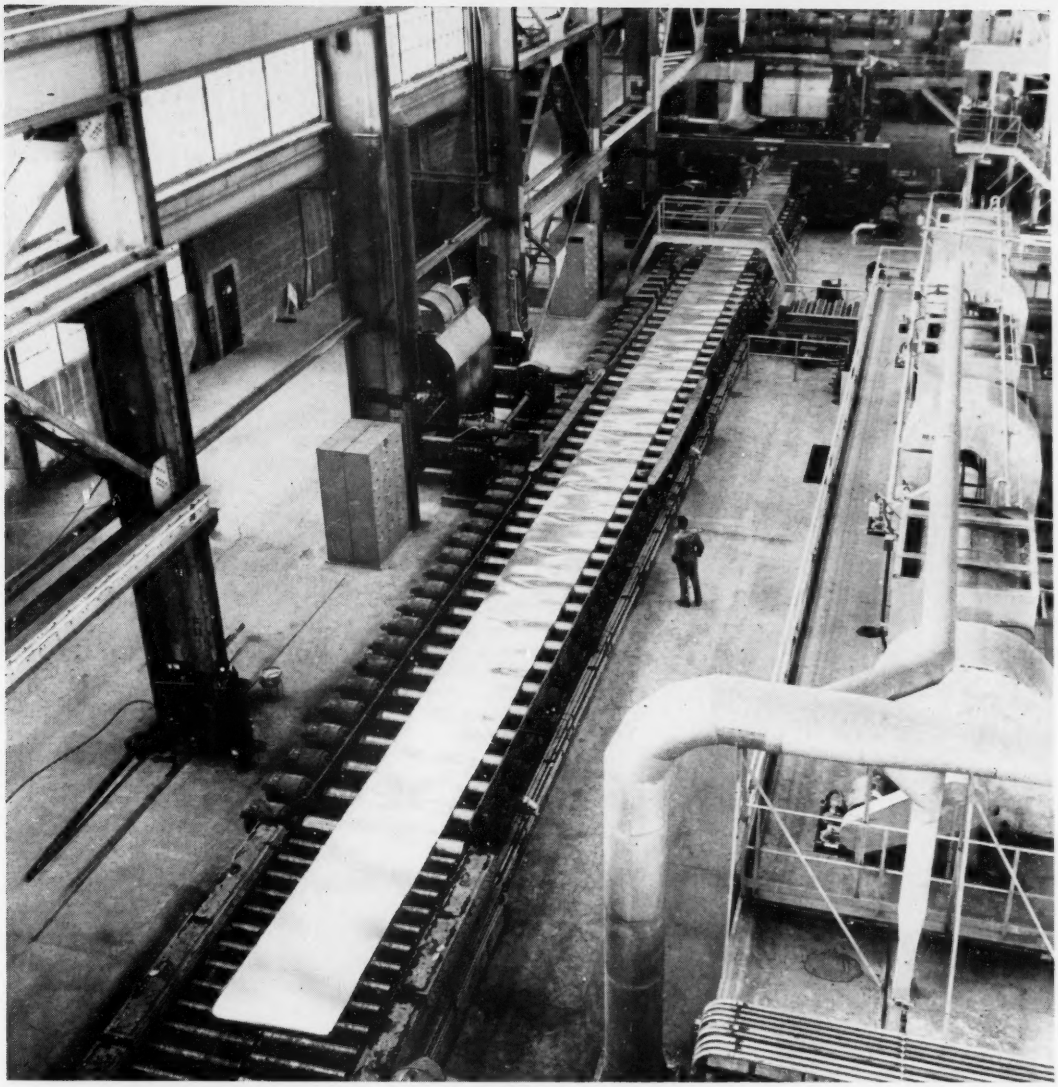
Coating Metal	Hot Dipping	Cementation	Electroplating	Spraying	Vacuum Coating
Aluminum	X	X		X	X
Cadmium			X		
Chromium			X		
Copper			X	X	
Iron			X	X	
Lead	X		X	X	
Nickel			X	X	
Silver			X		
Tin	X		X	X	
Zinc	X	X	X	X	

TABLE 4

Hardness of Electroplated Metals (Brinell)

Chromium	640-1020	Silver	60-79
Nickel	125-550	Zinc	40-50
Iron	140-350	Cadmium	12-22
Copper	40-130	Tin	8-9

Epoxy resin coats Whirlpool company washers as a primer to withstand abrasiveness and chemical reaction.



Magnesium sheet, pictured as it is being rolled in the Madison, Illinois, plant of the Dow Chemical Company.

Design With Magnesium For Lightness

By R. N. KINGSTON

But saving weight is just one feature! An increasing list of products are on the way to the markets whose design incorporates this metal. It just needs a little understanding to behave itself.

MOST DESIGNERS and engineers regard magnesium as essentially an aircraft metal; and then are often content to leave it at that. They appreciate its light weight and its quite useful strength properties; but they dislike its forming characteristics and know that it behaves rather badly under corrosive conditions. Times are changing! A saving in weight means a lot more than just having less to carry around. A reduction in weight of one moving part means weight being saved in a mating part—and so in the assembly that houses components. A lighter moving part imposes reduced loads on bearings, there is less vibration and from this a longer life. Bandsaw wheels, parts of a loom and spools for textile yarns and for wire are examples in this category. If a lighter weight will reduce fatigue in a metal, what will it do for a man? Anything which has

Continued over page

Magnesium is Light *continued*

to be carried or manhandled and whose weight can be reduced by 25% to 50% is going to be a blessing —especially toward the end of a working day. Portable tools and chain-saws, with cast magnesium bodies, tall extension ladders, dock boards and loading ramps, hand-trucks and even portable typewriters all show the advantage of straight weight saving. And the list can be extended many times.

There is just the job of getting around the waywardness of a metal which is a bit different from the others —which needs a little understanding if it is to be made to behave itself.

To some design engineers, the available data on magnesium and its alloys may appear confusing because of its volume and the very wide field it covers. This is a compliment to the metal itself, in that it has such widespread and varied uses; also to its protagonists, who have achieved so much in extending its usefulness over such comparatively few years.

As with most pure metals, unalloyed magnesium is of little interest to the design engineer—it is too soft to have any usable strength. To appreciate the different characteristics of the alloys which make magnesium structurally attractive, it is useful to know a little of their chemical composition and the quite simple terminology used to designate them.

In brief, an alloy is considered as having two principal alloying elements present in the alloy to the nearest whole number. Slight differences or modifications of the basic alloy are distinguished by letters, in alphabetical order, and a final letter-number combination indicates the condition, type of heat-treatment or degree of work hardening.

This system, which has been proposed for general adoption by the ASTM for designating aluminum as well as magnesium alloys, was first used, in part, by the Germans, who were the first to produce structural magnesium alloys on a commercial scale.

Without listing the whole of the system, as some of it is irrevelant, Table . . shows that part of it is in common use today.

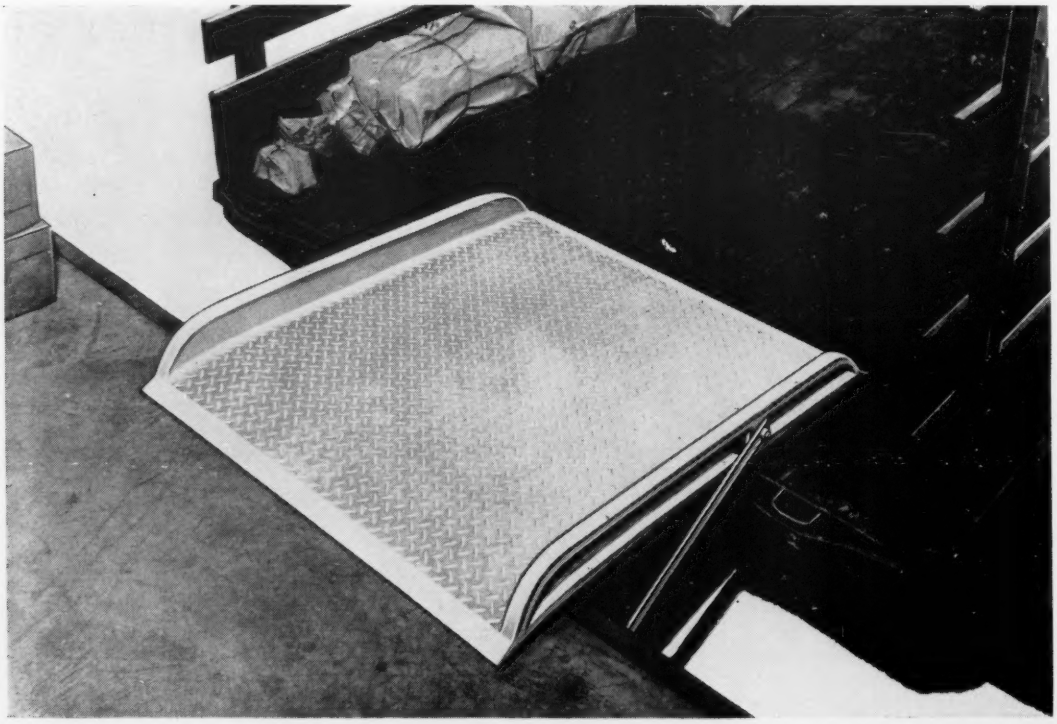
So AZ 91C-T6 designates a magnesium alloy, the third of its type, with 9% aluminum and about 1% zinc, which has been solution heat-treated and artificially aged. EK41A-T5 indicates the first alloy of a series containing 4% rare earths, mostly cerium, and 1% zirconium, in the artificially aged condition.

The 1953 figures (see Table) for the U. S. consumption (tons) of magnesium products, gives a good indication of the over-all usefulness of the various forms in which magnesium alloys are produced. They also show the line along which greater use should be and can be, expected.

As with several other metals, the low alloy compositions are more tractable than those with higher concentrations of alloying elements. This means that, with the simpler and leaner compositions, the metal can be formed to shape but as the alloy becomes higher in its percentage composition, or the alloying elements become more complex, the wrought forms are more difficult to produce and the metal can only be cast.

Like the other well-known light metal, aluminum, the use of magnesium falls into three groups and these reflect largely the relative volume consumption of the metal.

Commercial usage is confined to comparatively few



As a good example of magnesium fabrication, here is a loading dock board in use on the rear of a truck.

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Alloying Elements and Treatment

A—aluminum
E—rare earths (Cerium)
H—thorium
K—zirconium
M—manganese
Z—zinc
F—as fabricated
O—annealed
H 14—strain hardened
H 24—strain hardened and partially annealed
T 4—solution heat treated
T 5—artificially aged only
T 6—solution heat treated and artificially aged

U. S. Tonnages in 1953

	tons
Castings, sand	11,584
" , die	3,057
" , permanent mold	2,658
Extrusions	5,500
Forgings	200
Sheet	2,743
Total	25,742

Another illustration of magnesium fabrication — this aircraft hydraulic primary reservoir shell assembly.

English, German custom-built cars are in use with an all-magnesium body

types of magnesium alloy and these have been used in fair quantities, mainly as castings, for a number of years. The second and third groups are allied under the general term of "special alloys," developed quite recently. These take care of needs, mainly of the aircraft industry, for alloys having high strength at ambient and moderately elevated temperatures (group 2) and of the aircraft engine, particularly the jet engine, manufacturers who require the lightest metal, which will withstand their higher temperatures. In these, the accent is placed, not so much on mechanical properties, as on creep strength—or, the ability to withstand a certain stress level without yielding excessively under the influence of load and heat (group 3).

The aluminum-zinc alloys are confined to group 1, which is natural because they are well established and fairly simple to produce and use, also because these alloys are not man enough for the more rigorous conditions of service in present-day aircraft and engines.

It is well known that what the aircraft industry does today, the other transportation industries will do tomorrow. So the special magnesium alloys will not have a reserve placed on them, to limit their use in the aircraft industry; when fully developed, they are sure to find their way into railroad equipment, automobiles and trucks.

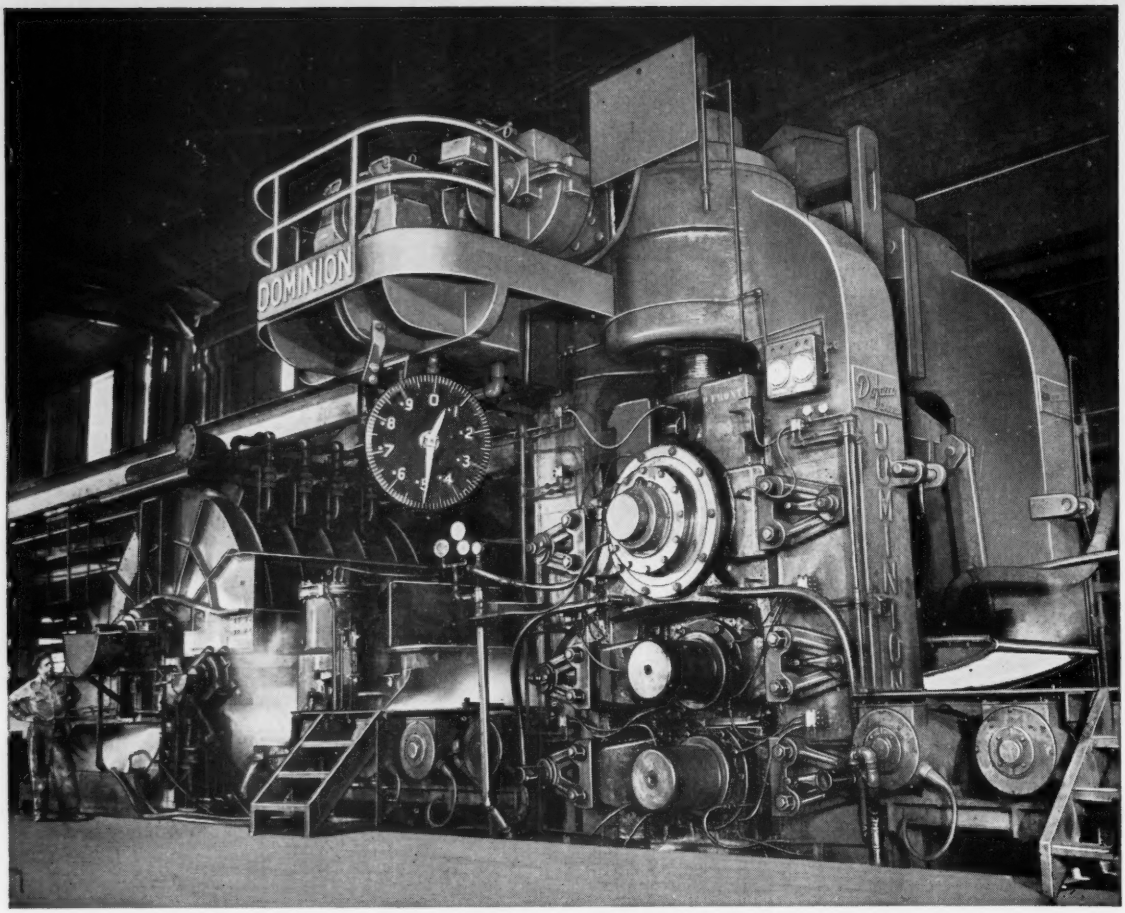
In France today, the all-aluminum car is in production and in England and Germany, custom-built cars are in use with magnesium bodies.

There are three extrusion alloys—AZ31, AZ61 and AZ80 and four casting alloys—AZ63, AZ80, AZ91 and AZ92. The wrought alloys are covered by aluminum contents varying from 2% to 6% with a fairly constant and low zinc content, but the casting alloys use a higher range of aluminum. In this series of alloys, it is the aluminum which provides the strength and the zinc which improves the fluidity for casting, except that with the higher zinc contents, there is a tendency toward hot-shortness and micro-porosity.

If a short list of alloys were wanted for simplicity, it is likely that it would consist of AZ31 for sheet, AZ61 for extrusions and both AZ80 and AZ91 for castings, the former in the T4 condition, in which the alloy is remarkably tough and the latter in the T6, in which it gives high strength, especially yield strength, with just enough ductility to be useful.

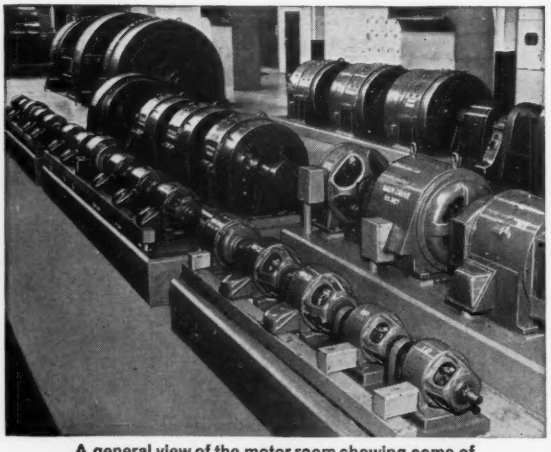
Consider now design engineers who are faced with the problem of high strength at ambient temperatures and with the maintenance of high strength at elevated temperatures. The ZK60 alloy (ZK61 in Canada), used as an extrusion, is outstanding and has behind it a background of three to four years' operational use, mainly in aircraft. The same alloy is also available as castings, with very useful properties; it has a slight edge over ZK51-T5, which is preferred in some quarters because of its simple heat treatment and because it is claimed to have a greater freedom from micro-porosity —especially in heavy sections.

HK31, a new sheet alloy, is not greatly superior to AZ31 at normal temperatures but it retains its strength properties at elevated temperatures far better. The cast rare-earth alloys are essentially gas-turbine alloys and although inferior to some of the AZ-series at ambient temperatures, **(Continued on page 49)**

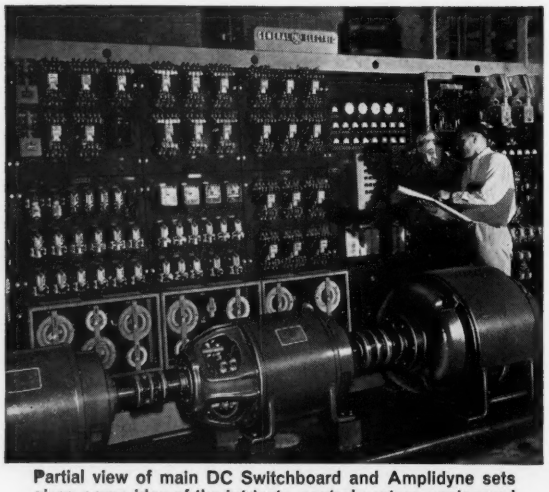


G-E Motors and Controls power and co-ordinate the operation of this new Reversing Hot Strip Mill at the Dominion Foundries and Steel Limited plant in Hamilton, Ontario. The new mill rolls hot strip and sheet steel with the highest level of uniform gauge and shape, at the rate of 1,800 feet per minute.

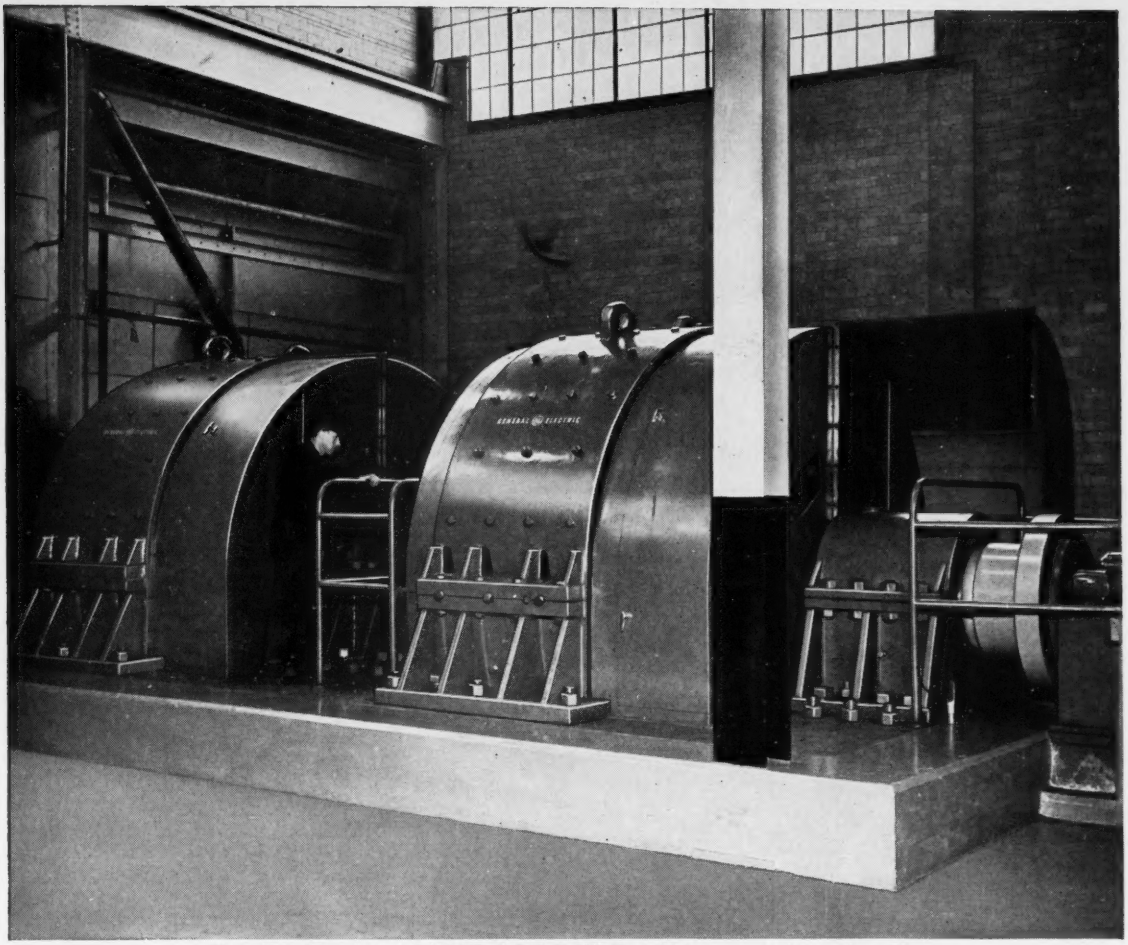
C-G-E Application Engineering Helps



A general view of the motor room showing some of the G-E motor and generator sets used to operate Dofasco's new Hot Strip Mill, in Hamilton, Ont.



Partial view of main DC Switchboard and Amplidyne sets gives some idea of the intricate control system engineered by C.G.E. to co-ordinate the operations of this new mill.



The mill is driven by two 3,000 HP G-E D.C. Mill Type Motors mounted in tandem. They are supplied by a motor generator set consisting of a 7,000 HP, 13,800 Volt, Synchronous Motor, driving two 2,500 KW G-E Generators. There is also a 2,000 HP auxiliary M.G. set.

DOFASCO Increase Production . . . Add Two New Products

With the completion of this multi-million dollar reversing Hot Strip Mill at Dominion Foundries and Steel Limited, Hamilton, C-G-E Application Engineering scored another success in helping Canadian Industry increase production, and manufacture improved, new products.

The custom-built co-ordinated motor drive and regulating equipment—G-E Motors, and Controls—were integrated to assure simplicity of operation and to yield consistent, high-quality production. This new mill will roll hot strip at 1,800 feet per minute—twice the speed of the former 4-hi mill. In addition to increased production, Dofasco now produces two new products with this equipment—hot rolled sheets and hot rolled strip steel.

The G-E Equipment driving and co-ordinating this new mill was developed expressly for this operation by C-G-E Application Engineers. The result: highly consistent production quality, and low cost operations.

C-G-E Engineers have developed similar functionally-simple, automatic drive equipment for just about every type of Canadian industry. To discover how G-E Co-ordinated Equipment can increase efficiency in your plant, contact your nearest C-G-E office, or Apparatus Division, 212 King St. W., Toronto, Ont.

GENERAL ELECTRIC

CO-ORDINATED EQUIPMENT

AAD-66701

CANADIAN GENERAL ELECTRIC COMPANY LIMITED

Patents

Some new ideas win protection in Canada

A METHOD of "cushioning" the seams of metal cans to prevent air leakage caused by rough handling is protected by Canadian Patent No. 512,451, issued on May 3, 1955 to American Can Company of New York.

A flange on the upper and lower edges of the walls of the container is interfolded with a flange on the cover and a resilient gasket of rubber or similar material is placed between the two outer layers.

The novel feature of the construction, invented by Delbert E. Wobbe of Maywood, Illinois, is the idea of bulging outwardly the outer layer of the seam to make localized recess around the can between the outer layers. The gasket expands into the recess and provides an extra thick cushion to prevent leakage of air if the seam becomes bent.

• • •

A MINIATURE electrical inductance element having a ferrite magnetic core was patented in Canada on April 26, 1955 by Western Electric Company. According to the patent, No. 512,379, the inductance element reduces flux leakage and increases inductance by increasing the permeability of the core. This means that the size of the element may be reduced.

Invented by John K. Galt, of Summit, New Jersey, the element has a magnetic core fabricated from a single mechanically sound crystal of ferrite in the form of an integral closed polygonal ring. The members of the ring are orentated with reference to the axes of the crystalline material in such a way that the legs of the polygon lie along the directions of easy magnetization.

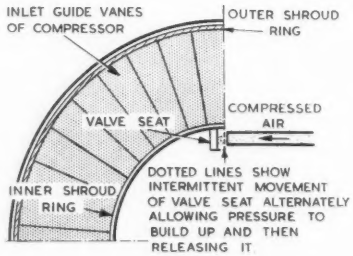
The windings extend completely around the core, which can be used with one winding as an auto transformer or choke coil and with two windings as a transformer.

• • •

A new way to de-ice the inlet guide vanes of gas turbine engines for aircraft was patented by Westinghouse Electric Corporation on April 26, 1955. The system depends on artificially created vibrations in the structure supporting the guide vanes, as shown in the illustration taken from Canadian Patent No. 512,385.

The guide vanes are secured between inner and outer shroud rings. The outer shroud ring is secured to the outer casing of the engine and supports the whole assembly at its outer diameter, so that the vanes support the inner ring. An air vibrator is used to produce an intermittent or pulsating torque on the inner ring, causing repeated bending of the guide vanes to dislodge ice forming on them.

The air vibrator described in the patent has a rigid pipe for compressed air leading from a port of the compressor downstream on the guide vanes. The end of the pipe is covered by a valve seat secured to the inner shroud ring. The air pressure forces the valve seat away from the pipe end, moving the inner



ring and bending the vanes. But this releases the pressure faster than it can be built up through the pipe and allows the valve seat to return to its position against the outlet under the force exerted by the elastic vane structure. The pressure builds up again, and the whole cycle is repeated at high speed.

The inventor is Arnold H. Redding of Wallingford, Pennsylvania.

• • •

A method for applying a layer of aluminum to a strong steel backing is described in Canadian Patent 513,279, issued May 31 to General Motors.

The composite strip may be produced by a continuous process, as illustrated. The steel is electroplated with copper and the two layers are heated to about 1000 deg F. and rolled together under pressure. Other strong metals may be used instead of steel.

The inventor is Harold W. Schultz of Dayton, Ohio.

• • •

A PROCESS OF molding resin treated coils has been patented in Canada by Westinghouse Electric Corporation. Patent No. 512,592, issued on May 3, describes the process: an electrical coil is wrapped with paper insulation and the coil is placed in a mold with a coil-shaped cavity. A fluid resinous composition which solidifies when it is heated is pressed into the mold and the mold is compressed to compact the coil.

The resin is then heated by passing an electric current through the coil to solidify the composition.

Warren M. Trigg of Pittsburgh is the inventor.

• • •

A CASE HARDENING bath composition for iron, steel and ferrous alloys has been patented by Heatbath Corporation of Springfield, Massachusetts.

Patent No. 513,285 issued May 31 describes the case-hardening composition as containing:

	Parts by weight
Sodium cyanide	10 to 40
Sodium chloride	5 to 45
Sodium carbonate	5 to 35
Alkali metal fluosilicate	2 to 20

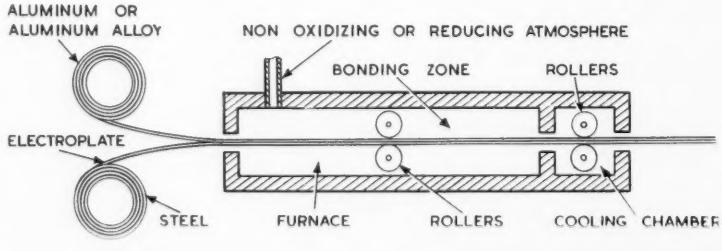
It was invented by Isaac L. Newell of Wethersfield, Connecticut.

• • •

A PADDED METAL binding tape—said to be suitable for binding articles such as refrigerators, which have surfaces that must be protected from the binding tape—was patented on May 31, 1955 by Sackner Products, Incorporated of Grand Rapids: Canadina Patent No. 513,332.

With this arrangement, the paper supports the padding beyond the side edges of the metal where it will cushion the edges of the metal against the article being bound.

The inventors: Daniel J. Wall of Portsmouth, New Hampshire and George F. Reinhard, of Grand Rapids.



Sell Management

(Continued from page 33)

whilst if too large, it may have to be put on an easel or pinned to the wall, and so fail to hold interest.

A model of a new device is, of course, much better than a drawing of it. New bus designs are best made up as models to a scale of one inch to the foot. A wooden model was made to show the cross-section of the first hydraulic torque converter and was tinted to show each blading assembly. A very good description of how to make clay models which can hardly be told from the final production job is given in "Industrial Design" by H. Van Doren.

In presenting a progress report, engineering can make use of photographs, but nothing is quite so satisfactory as to see the machine itself. An engine or transmission can be shown running on the dynamometer or, better still, demonstrated on the road. Engineering can learn much from such a demonstration. How does the new unit appeal to its first "customer," does its appearance make a favorable impression, is it quiet and smooth in operation?

Usually management will want to know when the new model will be ready for production. This is often a difficult question to answer, but engineering must be prepared to present a list of tests still to be made and to agree upon a date for release.

Another picture here shows a progress report on the development of a new truck engine. It summarizes the work done on the combustion chamber. Note that this chart shows only one factor in engine performance, the brake mean effective pressure, and that each curve is clearly identified right on the chart.

Finally we come to the presentation of a project that is ready for production. This should include a short summary of all tests and it will usually be found impossible to complete all testing before release to production. This seems poor engineering, but the fact is that if a few defects show up in service it is not so serious as to bring out the new model a year too late. Management will want to know that the release has been worked out with production, tool design and purchasing departments.

A successful presentation is a fine morale builder for an engineering department. Be sure to discuss each project fully with the men who are working on it, let each man feel that he is helping to make the presentation a success. Know what you want and be prepared to fight for it, because as James Zeder has said: "As engineers, our success is measured not by how much we know, but by how much of our information gets into use. ★

AIRCRAFT
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TYPE 12

PORTABLE COMMUNICATOR

VHF 118-148 MC

PRACTICAL APPLICATION FOR DESIGN ENGINEERS

This Portable Communicator can solve your problems for ground or shipboard use in air-ground communications. It can be placed in operation in a matter of minutes—the only additional requirement is a 24-28 volt, 4 ampere DC source.

Distance Range: 50 to 100 miles with aircraft at 3,000 to 10,000 feet and ground antenna at 30 feet.

Weight: including carrying case and all accessories: 36.7 lbs. Dimensions of the carrying case in inches—18⅛ x 8¼ x 18 5/16.

Input Power: While receiving 3 amperes, 24-28 volts, dc. While transmitting 4 amperes, 24-28 volts, dc.

Whistle Through Receiver Tuning Feature: Receiver may be instantly tuned to frequency of crystal selected by pushing 'whistle through' button while tuning the receiver.

Antenna Cables: Three lengths supplied, 10, 20 and 50 feet, together with co-ax junctions for joining the cable if lengths longer than either of the three supplied are required.

Microphone: Aircraft, single button, carbon.

Headset: Type ANBH-1, 600 ohms.

Speaker: 5 inch PM.

Insulation: Silicone-treated ceramic insulation is used to increase reliability under extremes of moisture and temperature. All paper and electrolytic capacitors are sealed, using silicone washers and silicone-treated ceramic insulating plates. The equipment is suitable for operation in the wet-hot tropics or the dry-cold arctic.

For full ordering information and details of all items contained in the carrying case of ARC No. 16413, write directly to:

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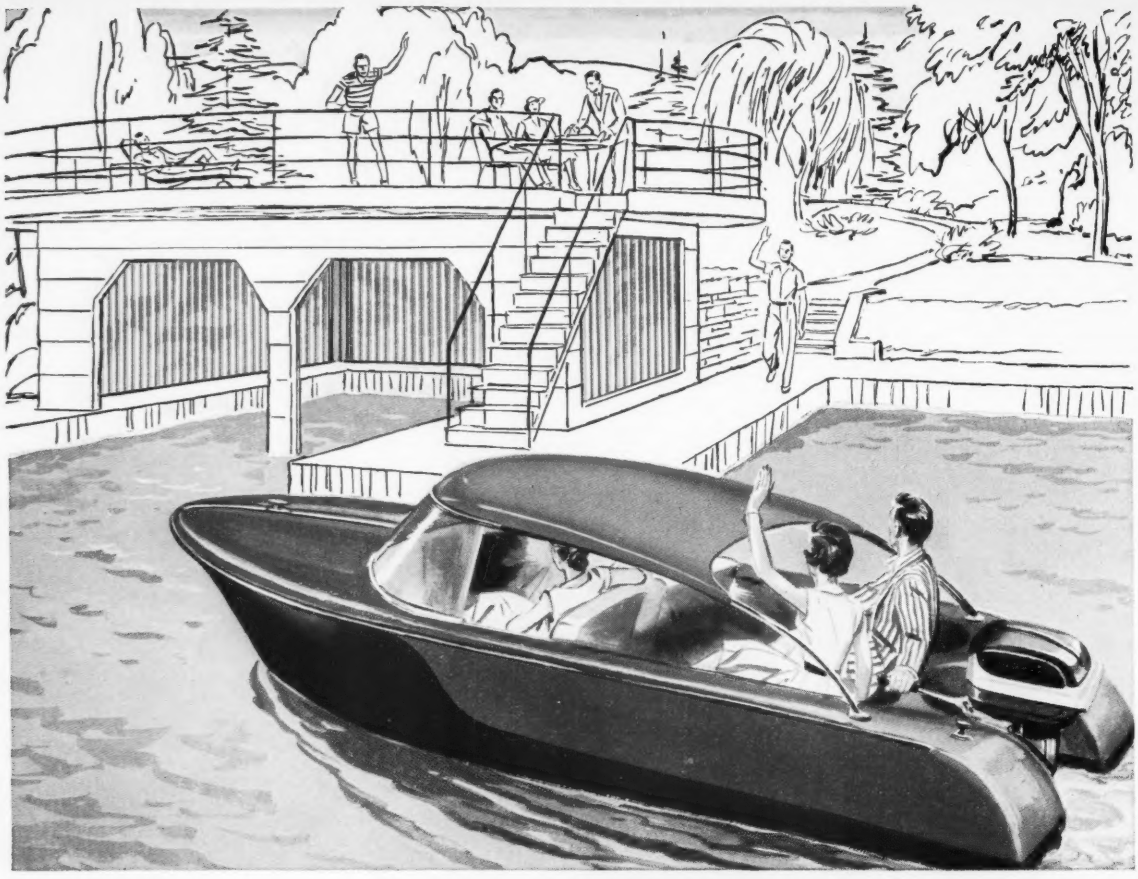

it's all play and no work with a boat made of ... Vibrin

IN THE PAST, boat enthusiasts needed plenty of muscle or money — or both — to keep their craft in trim. Vibrin has changed all this.

This polyester resin, made in Canada by Naugatuck Chemicals, is the key material in the manufacture of plastic boats. In the cruiser above, Vibrin is used for hull, deck, and cabin. It does away with painting, scraping, and caulking. It cannot rot, leak, or absorb water. And, because of its light weight and smooth finish, Vibrin permits greater speeds from any given horsepower.

Reinforced with glass fibres—as in plastic boats, Vibrin is many times stronger than steel on a weight basis. It is rust-proof and resistant to most acids. Forming is easy. Molds and tools can be inexpensive as pressure and heat are not necessary.

Vibrin is already being used for translucent sheeting (as used in this boathouse) fishing rods, machine housings, car bodies, chemical piping, aircraft parts, as well as for boats and many other purposes. Profitable applications are almost limitless. Short runs are especially economical.

Find out how Vibrin can improve present products, cut manufacturing costs, and give reality to ideas which were impractical with other materials. Call or write Naugatuck Chemicals in Elmira, Ontario, or branches shown below.

Other NAUGATUCK Plastics:

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Vinyl resins offering good physicals, easy processing, low temperature flexibility, and resistance to oils, acids and wear.

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Molding and extrusion compounds combining the rigidity of plastics with the tough elastomeric properties of rubber.

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DIVISION OF DOMINION RUBBER COMPANY LIMITED
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Magnesium

(Continued from page 41)

are better as operating temperatures increase. They could be of interest to manufacturers of automatic bread-baking equipment and for conveyors in moderately heated enameling and stoving ovens.

As mentioned previously, the greatest consumption of magnesium is in castings. Whilst not the easiest metal to cast, it is readily castable if its idiosyncrasies are appreciated. It needs headers half as big again as those used with aluminum; also care is needed to hold back any flux during pouring that might enter the mold and there is also a special technique to produce a fine grain, either by overheating or by nucleation. It can be die-cast and cast in permanent molds and the finish is exceptionally good.

Table 2 shows that of the 1953 consumption of magnesium products, only about 10% of the total was in the form of sheet. This, in turn, suggests that the volume of formed parts was quite low. The reason for this is partly due to the reluctance of processors who had difficulty in forming magnesium by conventional methods, to study and develop the technique which it demands. This is not surprising in view of the fact that the average cold bend radius of annealed AZ31 is 5t, with a springback angle of 8 to 10 deg and of hard sheet 10t and a springback of 12 to 15 deg.

Probably the most useful insight into the technique for forming magnesium comes from studying the characteristics of its single crystal. This has a close-packed hexagonal lattice and is capable of being extended to three times its original length, without fracture, by slip on the basal planes. If the deformation is carried out at a temperature above 440 deg, slip may occur on the 12 pyramidal planes and if the temperature is raised still further to 570 deg, the original length can be extended nine times by slip on the basal planes. So, at room temperature, the magnesium crystal has comparatively limited ductility but becomes highly ductile at temperatures between 400 and 600 deg F. The response of magnesium alloys to cold work (shown by improved mechanical properties), is evidence of the susceptibility of the alloys to strain hardening; but if the cold work is not precisely controlled, lattice distortion at once ruins the material. The difficulty of forming magnesium can be connected, therefore, with its small capacity for work hardening without rupture. Since distortion of the lattice can be removed by annealing at temperatures below those normally used in rolling magnesium, it follows that the rate of annealing is critical; for successful hot forming, the rate of removal of distortion by annealing should exceed the rate at which distortion of the lattice by deformation would occur.

With these facts in mind — the much-improved ductility at elevated temperature and the prevention of work hardening by hot working — the door to the successful forming of magnesium is opened.

Heat can be applied directly to the sheet and/or to the forming dies, by direct contact with a flame or by conduction from an electrical source. Even heat-ray lamps are quite practical. No matter what source is used, the important thing is to have the part of the metal which is going to undergo deformation brought up to the correct temperature before the actual deformation takes place. It is useless, for example, to place preheated sheet on a cold die and expect a satisfactory pressing to result. One well-known fabricator of magnesium parts has had no difficulty in producing a 12-in. deep pressing in 0.081-in. thick sheet, in a single draw. The operation is carried out in a double-action press, using preheated sheet and with dies heated by gas burners.

The welding of magnesium is not more difficult than the welding of some of the weldable aluminum alloys and the technique is very similar. The affinity of the molten metal for oxygen makes the use of protective fluxes or a protective atmosphere almost mandatory. Gas welding is slightly hazardous because of difficulty in removing flux from the weld metal itself; their densities are much the same and these fluxes, which contain chlorides, are highly corrosive to magnesium and must be completely removed. To avoid this risk of contamination, inert-gas welding, using either helium or argon, has become popular and successful. No fluxes are used and oxidation of the welded joint is prevented by the protective gas blanket, which envelopes the molten metal.

Spot and seam welding of magnesium is possible but is dependent on a chemically clean, oxide-free surface, immediately prior to the resistance-welding operation.

Magnesium has earned for itself a rather poor reputation as a resister of corrosion, but this is not entirely true. When first produced commercially the metal contained a number of harmful impurities, principally iron, copper and nickel, which, on exposure in a corrosive atmosphere, caused rapid deterioration atmosphere, caused **(Cont. on page 61)**

Is there any Real Protection?

What protection is there for new product designs in Canada? No one really knows.

The law says that original designs can be registered to prevent copying. But few designs ever are.

Some designers and manufacturers have given up the idea of registering new designs; they think registration is almost useless. Others say that registration is better than no protection at all. In fact, some manufacturers have found that failure to register can be a very costly mistake. But they all agree that the law is not good enough. Why?

Basically, it is said, because the design law is 50 years behind the times. Our Design Act does date back nearly 50 years—to 1906. And its most serious defect is this: it doesn't say what a design is. So the Courts have had to look at the general wording of the Act to decide what it means by "design."

Here and there the Act mentions a design "applied to an article," and so the Courts decided many years ago that a design is an applied pattern or ornament. (Fifty years ago, that's what design usually was: carved or painted decoration.) But this leaves out the form of the article; it leaves out its proportions; it leaves out modern design altogether.

Does this mean that you can't register a design of shape or form? No. You can usually get a registration if you file a proper application. But it does mean that this kind of registration might not stand up against a copier in Court.

Last year the federal government set up a Royal Commission to look into our patent, design and copyright laws. It has heard from designers, manufacturers, patent attorneys. Nearly all of them have said that Canada needs a really up-to-date design law. Perhaps now we shall get one. (Roy Jackson.)

New products & materials

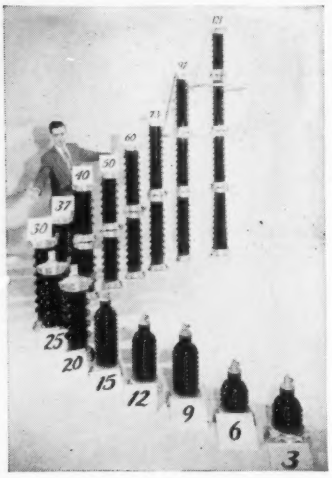
New items which can help you on the job

AN ENTIRELY NEW and extended series of line-type arresters, improved to provide 20% lower discharge voltage and 10% lower spark-over voltage than the preceding series, has been announced by **Canadian General Electric Company's** Apparatus Division.

The range of the new series has been extended to include ratings from 3 through 121 kv.

Called Thyrite Magne-valve line-type arresters, the units use the principle of magnetic action to aid valve action. This design of the equipment allows discharge of lightning or surge currents through the valve elements to ground and extinguishes power-follow current by the action of magnetic coils exerting an arc-quenching force in the arrester gap. This Magne-valve principle was introduced in the company's station-type arresters last year.

The new arresters have a gap unit and



Line type arresters by CGE

magnetic coil that operate in conjunction with an improved composition of Thyrite valve discs having low resistivity (for low IR discharge voltage) and increased discharge capacity. (200)

• • •

IN ANNOUNCING their No. 624 Stelco iron powder "Electrod" **The Steel Company of Canada** becomes the first Canadian company to produce and bring the advantages of the touch-type iron-powder-coated electrode to the electric-arc-welding field in Canada.

No. 624 is a shielded-arc-type electrode designed for fast, easy operation in flat or horizontal positions with a-c or d-c polarity.

This electrode belongs to the relatively new class of drag or contact electrodes. It is suitable for fillet or butt welding and for groove welding in general fabrication, structural work, truck bodies, railway car frames, tanks, farm implements and heavy machinery.

No. 624 operates with a minimum spatter and produces a slag that is easy to remove and is, in fact, self removing in many cases. Wash-up on metal is excellent in groove welding and there is no danger of undercutting in any application. (201)

• • •

A NEW HIGH STRENGTH aluminum alloy, Revere alloy 6263, designed for the electrical industry has been announced by **Revere Copper and Brass Inc.,** one of the first and largest fabricators of copper bar for electrical uses. The development is the culmination of their joint research with the **Aluminum Company of Canada.**

The new development is a magnesium-silicide aluminum alloy tailored to satisfy the need for a lightweight, high-strength conductor. It has been approved by several large electrical manufacturers for busway applications.

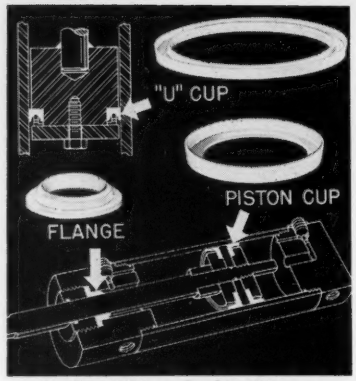
The standard EC grade aluminum alloy which has up till now been used as a conductor material, in the form of wire or rolled and extruded bar, has a somewhat higher electrical conductivity than the new alloy but much lower mechanical properties. This has limited its use in busway applications.

By very close control of magnesium and silicon and other elements common to most aluminum alloys, and by careful metallurgical control during processing, alloy 6263 develops mechanical properties approaching those of copper and an electrical conductivity approaching that of EC grade aluminum. (202)

• • •

PISTON-PACKING MOMMA—chemically inert piston cup, U-cup and flange packings have been developed by **Crane Packing Co.** to answer present-day hydraulic cylinder packing problems. Made of Du Pont Teflon, they are claimed to give positive protection against the corrosive action of all types of synthetic non-flammable fluids.

The new packings can be used at operating temperatures up to 350 deg F, and are self-regulating to compensate for



Du Pont's Piston Packing Momma

pressure. Tested and used by major manufacturers for hydraulic cylinders, they are said to be meeting all performance requirements, even under the most severe conditions.

Piston cup packings are available in a standard range of nominal cup sizes from 1 in. to 12 in. and are recommended for pressures up to 2,000 psi. U-cup packings to suit either piston or cylinder specifications are recommended for pressures up to 1,500 psi. Flange packings are available for use up to 2,000 psi. (203)

• • •

A NOVEL METHOD for spraying a wide variety of solid forms (such as metals, glass, ceramics), in which powdered ceramic materials are fed through a simple flame gun and form a heat-resistant and chemically stable coating has been developed by the **Armour Research Foundation** of the **Illinois Institute of Technology,** Chicago.

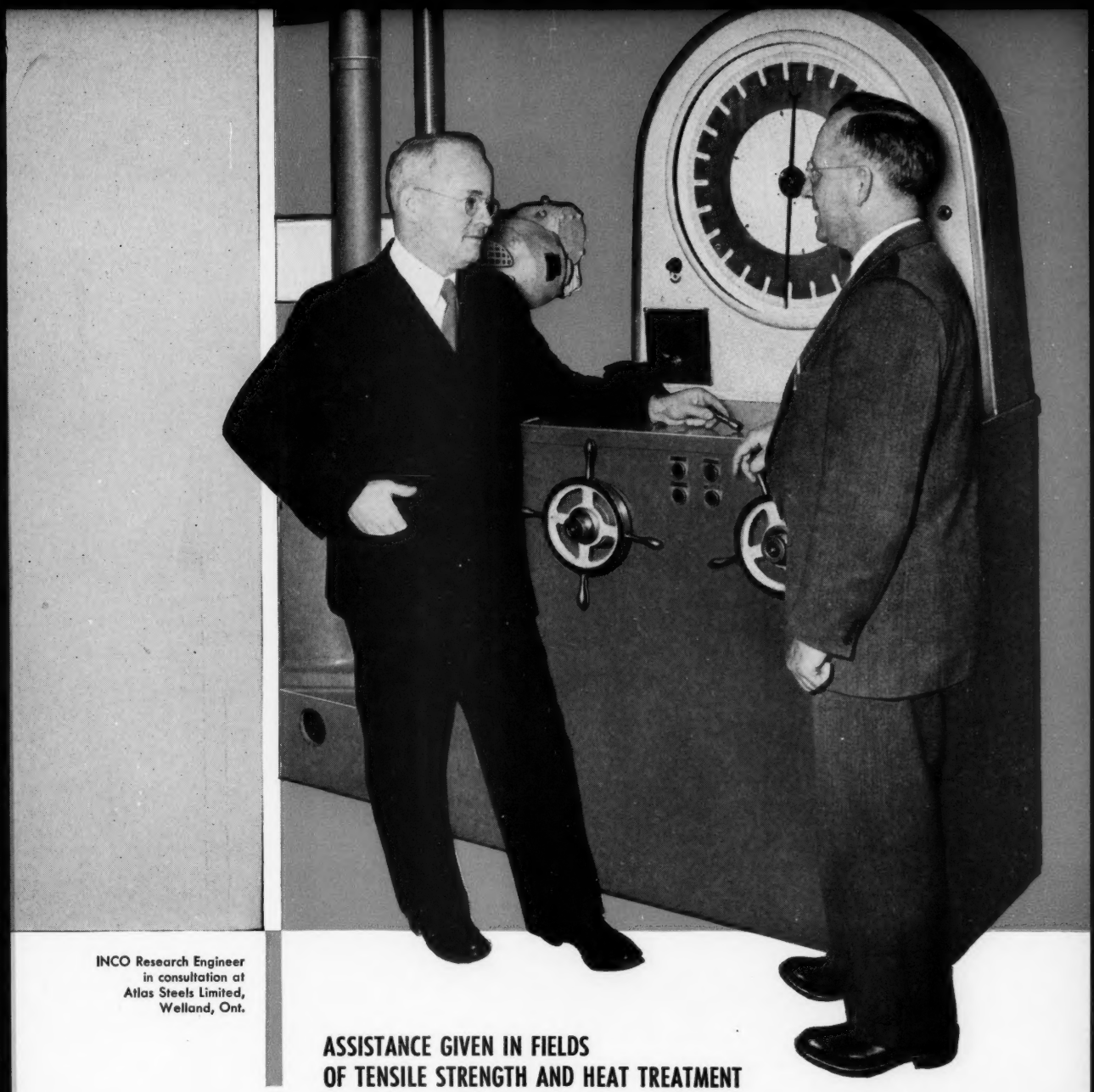
"Flame spray ceramics," as the new process is called, involves the use of sintered layers of refractory and chemically inert materials, such as aluminum oxide and zirconium oxide. Since these are stable metal oxides, they cannot oxidize further.

Coatings resulting from the new process, it is claimed, are superior to those produced by the metallizing processes because of their greater resistance to head and chemical stability. The technique of application is similar to that required for the metallizing processes.

"In many cases the underlying metal actually can be melted without causing coating failure," claims Samuel W. Bradstreet, supervisor of the chemistry of mineral products in the Foundation's ceramics and minerals research department.

Mr. Bradstreet predicted that the coating will find use in rockets, flame ducts, burner equipment, and as a liner for troughs, feeders, molds and other foundry equipment.

The aluminum coating is reported to be harder than tool steel and unusually adherent in thicknesses up to about 10 mils. (204)



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File

New booklets and books written for you

A MANUFACTURER of precision hydraulic and pneumatic components, **Aircraft Products Co.,** announces its new Bulletin 155.

This describes and illustrates the company's standard line of selector valves (solenoid and manually operated), resistor valves, sequence valves (slide and poppet types), check valves and shut-off valves (solenoid and manually operated). Line drawings, tables and flow charts give construction and operating specifications.

Special components manufactured by the company for aircraft and general industrial use are described and illustrated, including hydraulic and pneumatic actuators, spring and air-loaded accumulators, lock valves, solenoid operated fuel shut-off valves, synchronized shuttle valves, flap synchronizing valves, master brake control units, hydraulic canopy actuators and hydraulic aircraft steering controls.

The bulletin also tells: how modern production facilities and rigid inspection procedures insure the highest standards of precision (tolerances to millionths of an inch); how its service organization provides fast personal liaison (by company plane, in emergencies); how its highly specialized engineering staff has solved or helped solve difficult engineering problems, including the development of the first successful technique for plating chrome to aluminum. (205)

• • •

DETAILS ARE GIVEN of Spherical Valves in Bulletin 214-20 from **Dominion Engineering Co. Limited.**

With the development of high head hydro-electric power resources in Western Canada, a demand was created for a penstock valve which would be suitable for this rigorous service. This challenge was met by adding the spherical type of valve to the range of hydraulic valves. The spherical type of valve, with retracting seats and a rotating plug carried on grease lubricated trunnions, had long been in successful use in Europe for this type of service.

In order to gain full benefit from this experience, an agreement for complete and continuous exchange of knowledge concerning spherical valves was made with the well known French firm, Neyrpic, manufacturers of the first spherical valve with retracting seats and possessors of a wide background of successful field experience. Dominion spherical valve designs incorporate the experience obtained from the installation of hundreds of variations of this type of valve by Neyrpic and Dominion.

These installations cover a broad variety of applications, having been used in hydro-electric installations, city water works systems, industrial processing and supersonic wind tunnel service. Valves of this type have been made in sizes up to 83 in. in diameter bore and for working pressures ranging from 1,750 psi to almost complete vacuum. (206)

• • •

MORE THAN 25 actual design uses for the Neg'ator constant force spring are described and illustrated in a two-color, 16-page technical bulletin just published by **Hunter Spring Company.** It shows how the Neg'ator spring is being used to solve a variety of mechancial-loading and power-drive problems while it is giving better performance with fewer components and savings in space, weight and cost. The operation of this constant-force, long-extension spring and its six major forms are also pictured and discussed in terms of their utility in mechanical design.

The design applications explain, with drawings and photographs, how the Neg'ator spring has been used to maintain a constant pressure or tension; to drive a retracting reel; to counterbalance light and heavy loads; to power portable and mobile equipment; to exert a returning force; to clamp or clip; to close slots; and to expand a direct reading scale.

Suggestions for helping in the design of Neg'ator springs and motors are included in the bulletin, and an application worksheet is enclosed for the engineer. (207)

• • •

AN ILLUSTRATED CATALOGUE and selection guide describing the new VS Class 2 Gyrol Fluid Drive for general purpose industrial applications is now available from **American Blower Corporation.**

It discusses the advantages and applications of the new fluid drives, itemizing such factors as speed control, power savings, no-load starting, torque limitations, acceleration control, shock absorption and simplified installation. A sectional view illustrates construction features and the principle of operation. A complete description of how the drive operates is also included.

Also contained in the new catalogue are basic outline drawings which are keyed to a chart listing complete overall dimensions for six sizes of drive. Drawings and dimensions are also provided for both crank and lever type speed control mechanisms.

The selection guide consists of tables which indicate the proper type to use with drive motors rated from 7.5 hp. to 800 hp. Separate tables are provided for both variable torque and constant torque loads.

In addition to selection data, each table also lists minimum sheave diameter and maximum sheave width for V-belt drive, approximate full load slip and approximate force required to move the speed control lever. Four conventional arrangements for mounting the Class 2 fluid drive to the drive motor are illustrated. (208)

• • •

A BROCHURE from **Peerless Engineering Ltd.,** precision specialists in the design and building of press tools, molds and other production tooling, states that during the last thirty years it has supplied tooling for the manufacture of products such as electric motors and apparatus, aircraft instruments, dies for automobile body fittings, vacuum cleaners, telephone receivers and many mass-produced consumer items.

Peerless Engineering was established in 1925 and has been located in its present plant since 1941. The plant covers an area of 20,000 sq ft and there is plenty of room for expansion. Many of the craftsmen have been with the company for over fifteen years. (209)

• • •

A NEW EIGHT-PAGE bulletin, dealing with the Supairthermal engine-gear set for driving centrifugal compressors and high-speed pumps, is announced by **Nordberg Mfg. Company.**

It describes the advantages of the V-type engine-gear set for operation on large capacity gas pipe lines. For example, it can be used to drive a centrifugal gas compressor through a speed-increasing gear and save thousands of dollars in fuel costs. Such performance is possible because the particular design gives a thermal efficiency greater than 40%, with more horsepower, less oil consumption and lower maintenance cost per horsepower-hour.

In addition, the bulletin points to the compactness of the set and explains why it can be installed and operated more cheaply per horsepower-hour than any other type of gas pipe line prime mover.

Illustrations show the engine-gear set driving a centrifugal compressor and details of the speed-increasing gear. (210)

AEROQUIP HOSE LINES with Detachable, Reusable Fittings

Solve Design Problems

Extreme heat, cold, vibration, installation complexities, and other fluid line problems can be solved readily by the application of Aeroquip flexible hose lines. A variety of hose line types in a wide range of sizes and burst pressures meet every industrial need.

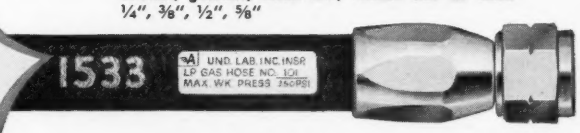
Aeroquip hose assemblies can be made right in your plant, *in minutes*, by cutting bulk hose to length and attaching the reusable fittings. An inventory of bulk stock permits the making of individual hose lines for mock up installations or thousands of hose lines for production runs.

Write for complete hose line information. If you want help on a specific problem, a qualified Aeroquip sales engineer will arrange a call.

Aeroquip double wire braid hose for high pressure hydraulic, hot oil, grease, crude and fuel oil, gasoline, and air lines. Pressures range from 5000 p.s.i. in ¼" size to 1000 p.s.i. in 2" size.

Aeroquip 1500 p.s.i. single wire braid hose for medium pressure hydraulic, water, hot oil, crude and fuel oil, anti-freeze solution, gasoline, diesel fuel, and air lines. ¼" to ¾".

Aeroquip 250 p.s.i. triple-ply cotton-reinforced hose with one-piece SOCKETLESS fittings for low pressure hydraulic, water, hot oil, crude and fuel oil, anti-freeze solution, gasoline, diesel fuel, vacuum and air lines. ¼", ⅜", ½", ⅝"



Aeroquip wire-braid-reinforced butane-propane hose for LPG engine plumbing or for fixed installations where vibration causes problems. This is the only butane-propane hose line listed by the underwriters' laboratories. ¼" to 2".

Aeroquip burstproof hose with *"little gem"* fittings for steam cleaning units, dry cleaning and pressing equipment, foundry equipment, plastic molding presses, steam boiler installations, rubber curing and vulcanizing equipment. ½" to 1".

Aeroquip Freon hose for use on automotive and commercial air conditioning units and refrigeration equipment using Freon 12. Sizes are ¼" to 2".

"little gem" is an Aeroquip Trademark

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U. S. Destroyer

(Continued from page 35)

high-temperature piping system as simple as possible, welded joints were used wherever possible instead of flanged joints, which were kept to a minimum. Austenitic steel was found to be suitable for welding but although ferritic steels could be welded, the process had to be closely controlled. The most awkward welding problem involved joining dissimilar materials, such as the austenitic steel superheater outlet headers and the ferritic steel piping. Welding was unsuccessful and mechanical joints had to be used.

The starboard plant has two boilers. These are capable of delivering 170,000 lb of steam each hour at 875 psi to the main unit which consists of cruising, high-pressure and low-pressure turbines. Up to about 25 knots, all steam is admitted to the cruising turbine, but above the cruising range part of the steam is admitted to the high-pressure turbine. Among the many new features of turbine design is the tip speed in the low-pressure turbine which reaches 1,410 fps — the highest ever used in naval installations.

The port plant's two boilers can deliver 160,000 lb of steam per hour at 2,000 psi. The tip speed of the low-pressure turbine blading in this case is 1,366 fps. The design of this blading is different in that it is not shrouded, but is provided with a tie wire which passes through a hole in each blade.

The Timmerman's electrical plant uses a 1,000-volt, 400-cycle, 3-phase system, supplied by two 600 kw synchronous turbo generators. All pumps and other auxiliary machinery (excepting feed pumps and main forced draught blowers) are driven by high-speed motors using silicone insulation. They are much smaller than conventional shipboard motors and so weigh less. It was also found possible to use newly developed, small diameter power cable for the 1,000-volt system in spite of its having been designed for 440 volts.

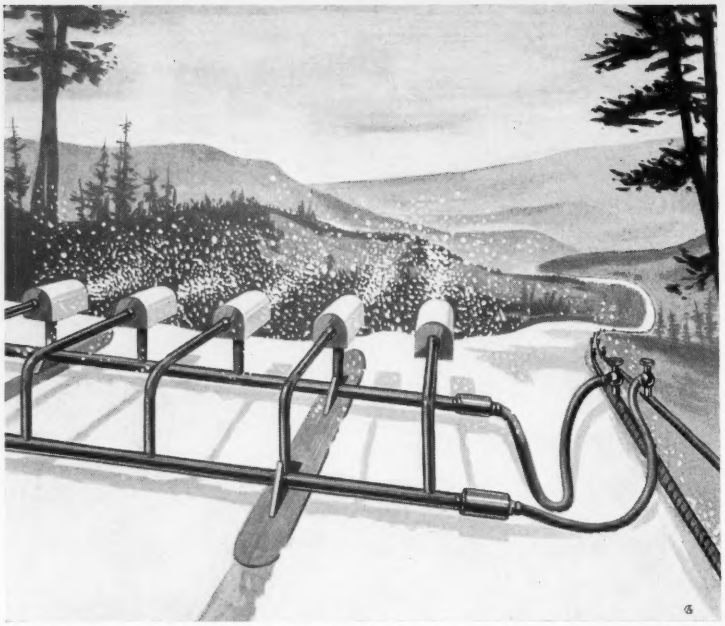
Many minor changes were made. In general, it can be said that where more than one unit or component was used the design, choice of material, and so on, was varied so that comparisons could afterwards be made.

To improve seakeeping qualities, the sheer line at the stern was raised 2 ft higher than in the DD-692 class. In addition, the forward 5-in/38 gun mount was moved aft 7 ft and lightweight anchors were installed.

The use of an all-aluminum deckhouse gave valuable information about welded, riveted and bolted aluminum construction. Welded construction was used on one side of the deckhouse and a combination of riveted and bolted construction on the other. The fabrication of a welded aluminum 5-in./38 gun foundation, which was later successfully tested, showed the feasibility of such construction; and valuable knowledge was acquired in welding, heat treating and quenching large, thick section structures.

The ship is equipped with a new type steering gear which uses a ball-bearing nut and screw with hydraulic drive, in place of the conventional hydraulic ram system. This unit weighs about one-

(continued on page 61)



DESIGN ENGINEERING'S *artist's impression of how the new snow machine will look.*

So Now We Make Snow-Falls to Order

SNOW WHEN YOU want it is now being offered by Wayne M. Pierce, Jr., of Milford, Connecticut. So winter resort operators need no longer stake their profits on the chance that the weather will produce their most valuable commodity — snow. His answer to bare ski trails that discourage paying guests is "real" snow — machine-made-to-order by apparatus that he has invented. Tey Manufacturing Company in Milford has taken up Pierce's invention, which uses batteries of special nozzles to convert air and water under pressure into a dense fog that freezes and falls as snow. The only help nature has to give is to drop the outside temperature below freezing.

By adjusting the ratio of water to air (and so the size of the water droplets) Pierce says that the consistency of his snow "can be regulated from a dry powder through a wet, heavy snow down to an ice glaze." Pipes carrying the air and water alongside the ski trail have paired outlets for connecting to flexible hoses leading to the nozzles. A group of nozzles can be mounted on runners to cover a section of the trail from each pair of outlets. "The water," suggests Pierce, "might be pumped from a nearby brook."

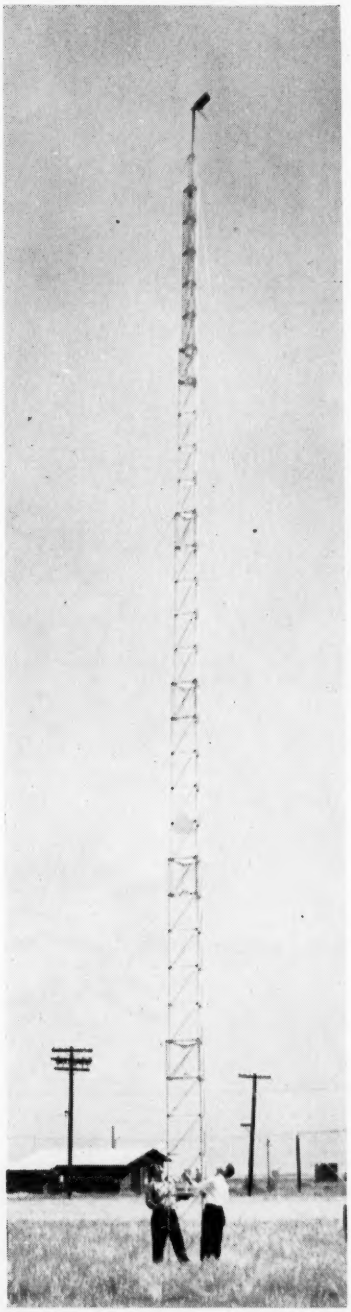
The secret of producing a fine enough fog, that can be varied for a wide range of types and temperatures, lies in Pierce's special mixing nozzles; they are designed to spread the water out into a thin sheet that is broken up into minute droplets by a blast of compressed air,

The inventor found that this simple form of nozzle worked well, but noisily. "It produced a weird, penetrating noise," he explained, "audible for great distances and annoying to operators and people long distances away." He found a way to silence it with an outer plate punctured by many small openings. Through them the water droplets are ejected.

A Canadian patent on the apparatus and the method of using it has just been issued to Tey Manufacturing Corporation. The patent suggests that the snow is formed because the smaller particles freeze and form "seeding" agents that cause the rest of the particles to collect and form snow flakes. It may be, Pierce thinks, that under certain atmospheric conditions, his method could seed the atmosphere for "natural" precipitation.

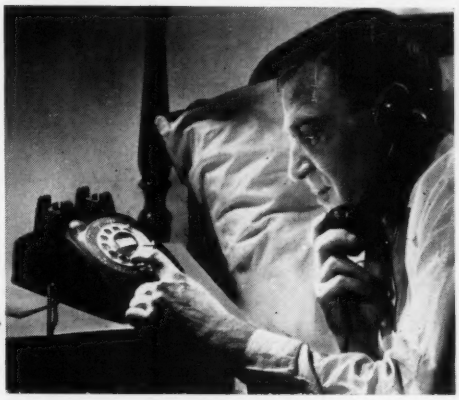
Design news in pictures

Some modern designs making news today



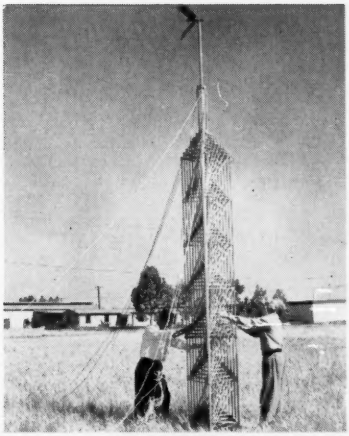
This crank-up aluminum tower marketed by Alpar Manufacturing is capable of reaching 92 ft. Light weight, 118 lbs., compact, it is nested (see right). Used in most parts of the world, tower may be installed temporarily, permanently.

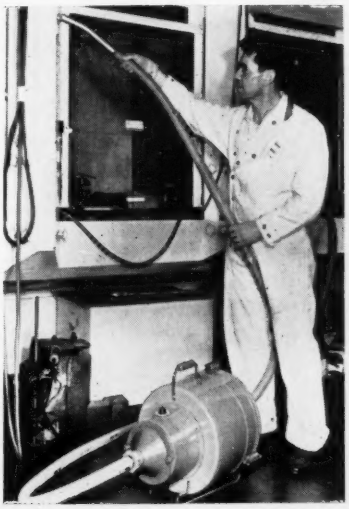
Someone ill? No need to disturb them with a call out. New phone from the Bell Lab has an illuminated dial that lights as handset is lifted. Many uses for business, home, when darkness is needed. Soon to be produced by Western Electric in U. S.



Hydrospin machine in use by Solar Aircraft is first in U. S. The disc at left, rotating at high speed under compression, turned cones of types in picture with a flange.

Ridding the lab at Harwell of radioactive dust, the operator uses a commercial vacuum with special filters and outlet from the Hoover Company's U. K. plant.





Six sections of aluminum ductwork assembled into a 16' length on the floor are easily lifted for erection.

for lasting client satisfaction

specify

ALCAN aluminum "UTILITY" sheet *for ductwork*

Aluminum ductwork lasts a lifetime! Its lower heat loss and reduced resistance to air flow increase efficiency. Client and owner prefer the clean bright finish of exposed aluminum ducts.

Aluminum is competitive in cost. Its light weight and ease of installation contribute still further savings. Freedom from rust does away with maintenance charges.

Alcan "Utility" is sold in coils and rectangles (up to 48″ widths) — in standard gauges. It conforms to C.S.A. specification HA.4.3-1951. The American Society of Heating and Air Conditioning Engineers approve aluminum for ductwork and endorse its use in the same thickness as other metals.

Write for descriptive "Utility" folder

ALCAN

ALUMINUM COMPANY OF CANADA, LTD.

Calgary • Halifax • Hamilton • Montreal • Ottawa
Quebec • Toronto • Vancouver • Windsor • Winnipeg.

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Here's the modern way to end lubrication troubles —install Farval

FARVAL—
Studies in Centralized Lubrication
No. 163

WHAT if your oiler uses the wrong oil or grease? Or maybe he's in a hurry and forgets a few bearings. Whatever the error, bearings may be ruined. A machine is down and expenses begin. All such troubles can be avoided by installing Farval Centralized Lubrication.

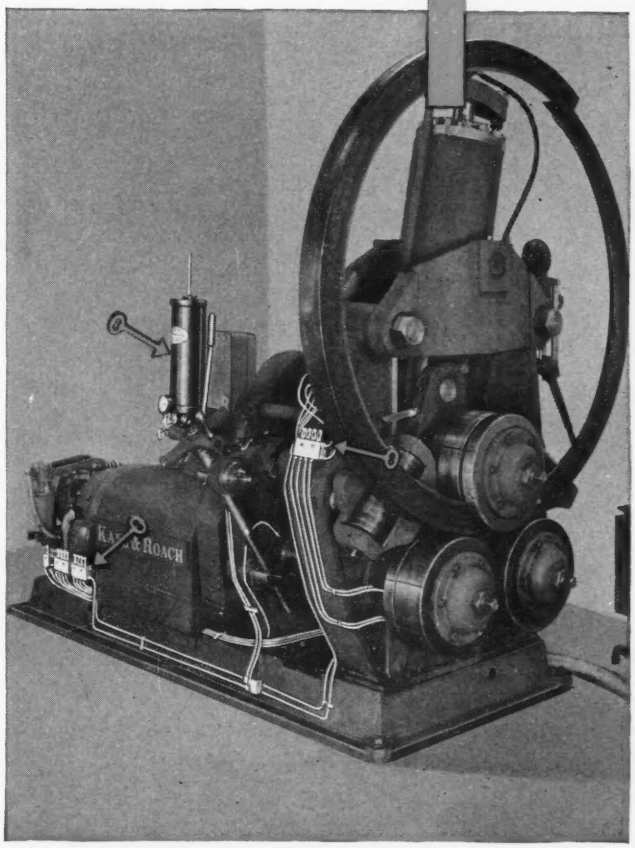
With Farval a measured amount of the *right* lubricant is hydraulically delivered whenever needed to the bearings of a machine. *No bearings are ever missed!* A "tell-tale" indicator at each bearing gives *positive proof* that the measuring valve has functioned and that the bearing has received the lubricant it needs.

Kane & Roach Installs Farval

This Kane & Roach Vertical Angle Bender is an excellent example of how one modern machinery builder protects his equipment from "human" error. According to this builder, the cost of just *one* shutdown due to haphazard lubrication would exceed the entire cost of its protective Farval system. With Farval installed, this machine can perform efficiently, with no danger of bearing failure. In addition, Farval saves oiling labor and lubricant!

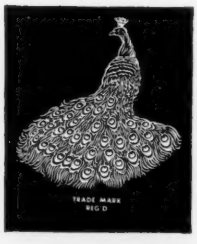
Free Lubrication Survey

Why not let us send a Peacock engineer to inspect your plant equipment? Without obligation, he will present a written analysis of how Farval can end your lubrication troubles. Write also for Bulletin 26 for the complete Farval story. Peacock Brothers Limited, P.O. Box 1040, Montreal 3, Que.



KEYS TO ADEQUATE LUBRICATION— **Wherever you see the sign of Farval—the familiar valve manifolds, dual lubricant lines and central pumping station—you know a machine is being properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.**

Pictured is a *Farvalized* Kane & Roach Vertical Angle Bender (Model 23) used for bending angles, channels, rounds, squares and other shapes.



PEACOCK BROTHERS LIMITED

MONTREAL

Sydney — Montreal — Toronto — Sudbury — Winnipeg — Edmonton — Calgary — Vancouver

Letters

Your views influence Canada's industry

● Mr. Buchanan's comments on my letter (DESIGN ENGINEERING June and July) are very informative. His nine-question check list to which a product is subjected before it may be entered for a National Industrial Design Council award indicates a broad scrutiny of the general standard of design.

The questions are, in some cases, loosely defined; but a design rating scheme must be flexible since designs are so varied. However, reference to "honesty of color" leads me to suggest a clarification.

In the acceptable conception of honesty it could only apply to lack of fraud, the endeavor to deceive the purchaser as to material or condition of his purchase—as was done by use of red leno covers over unripe peaches. Certainly if it were evident that the designer's intent was to swindle the customer, I am certain that the committee would reject it without further ado.

This leaves the question of "honesty of color" to be defined or replaced by a more apt description.

MAURICE CONKLIN
Mechanical Engineer
Toronto

● I find the comments carried on page 3 of your July issue concerning the background of Mr. D. A. G. Kelly rather conflicting with the enclosed page from the Journal of Institute of Metals.

I admit you refer to the British Aluminum Co., whereas I refer to the British Aluminium Co., but though east is east and west is west sometimes the twain shall meet.

H. WILKINSON
Metallurgist
Quebec

Reader Wilkinson enclosed an advertisement appearing now in Britain sponsored by the British Aluminium Company. In the July issue a remark from contributor Kelly was misinterpreted to say that the company had closed down in 1949. In fact, only a part closed down and the company is very much in business today. DESIGN ENGINEERING apologises for the mistake—and for the spelling error. It hopes a minimium of trouble was caused.—Ed.

● Whoever is responsible for the short abstracts and between-the-paragraphs captions ought at least to read the articles concerned. As a matter of fact the language and the errors of the former are quite disgusting in view of the relatively high standard of the latter.

I hope you will appreciate my criticism as well meant.

J. C. VRANA
National Research Council
Ottawa

It would be helpful to DESIGN ENGINEERING if well meaning Mr. Vrana would send examples of the disgusting language he has found.—Ed.

● I would like to take the opportunity to say how much I enjoyed your article on the Dart engine, bringing out as it did so many interesting facts on a timely theme.

HOWARD W. NORTON
Dominion Engineering Co.
Montreal

● I have examined DESIGN ENGINEERING and am very much impressed.

I like the easy informality with which the technical articles are presented and the layman's language used throughout the magazine. These seem to be valuable assets when the core . . . of a subject is to be ascertained and understood quickly by a busy reader.

I wish you every success . . .

W. E. ROBERTS
Aircraft Engineer
Toronto

● I agree with your editorial in the July issue that there are many reasons why product designers should be engineers—or at least should have considerable engineering training.

But a good product designer must be so much more than an engineer that perhaps we should train product designers in engineering instead of training engineers in product designing. For engineering factors are only one kind of the almost limitless variety of factors that find expression in an industrial product. To integrate them creatively needs a rare kind of broad, imaginative mind that the man who is primarily an engineer is unlikely to have; it needs a sort of intuitive "feel" for the right compromise between conflicting demands for low cost, top sales appeal and high performance; and it needs an imaginative appreciation of non-material, non-practical, non-logical realities like beauty and good taste that is more than a matter of training—qualities that may be lost by prolonged exposure to the disciplines of engineering training. (In fact I doubt whether this type of person is ever likely to start out in engineering—he is far more likely to choose architecture, journalism, psychology, art, advertising.)

In general, engineers tend to be practical specialists: inventive perhaps, but materialistic, logical, intellectual and uncompromising in their approach to a problem. As such, they have much to contribute to product design—in fact, the whole system of technical ideas and principles that is essential to every industrial article is their province. But are they perhaps less suited to the over-all designer's responsibility, and does this explain why there are so few engineers in the A.C.I.D.?

Industrial products are made for one purpose: to be bought and used by people. So they must fit in comfortably with the way people live, and a good designer must understand this and express it creatively in the operation as much as in the appearance of his designs. He must have engineering knowledge—lots of it (in the same way that a great painter must have mastery of technique) but if that is his first and primary interest I doubt whether he will ever become a comprehensive designer. Actually, the engineering knowledge he needs should be general and basic rather than detailed or specialized; as a non-specialist he will always have to rely on specialist staff engineers in particular fields for basic ideas, specifications of materials, calculations, predictions of performance and other such things.

A good designer is likely to be a man with a non-conforming, questioning, observing and, above all, a creative mind, who may not benefit much from a conventional course of study of any kind. He will probably be a bit of a misfit in most jobs. Look at the training of designer R. Buckminster Fuller — two years at Harvard, a year at the United States Naval Academy, an apprenticeship, among others, as a machine fitter in Boston, terms as assistant export manager and as accounts manager of a meat packing company, as sales manager of a truck company, research of another company, as technical editor of Fortune magazine—I see this as the kind of background that is likely to reflect the qualities of imagination and mental scope needed by a top product designer.

ROY JACKSON
Patent Attorney
Toronto

Magnesium

(Continued from page 49)

pitting. Certain industrial atmospheres and particularly marine areas (which have a chloride content), will cause fairly rapid general corrosion of the base metal to take place; but both the conditions can be largely prevented.

The presently produced base metal has an exceptionally high purity and is inherently much more resistant to corrosive influences. What is more, protective treatments have been developed which confer marked resistance to corrosion. Long-oil pigmented enamels, alkyd resins and vinyl-based paints have excellent protective properties and are sufficiently durable and tough not to chip or wear with normal handling; but they do not adhere well to bare magnesium and it is necessary to produce a surface layer on the metal, to which the enamel or paint will adhere.

Several immersion processes involving treatment in chromate baths have been developed, the most popular of these being the Dow No. 7. Recently, two anodic processes, the HAE of Frankford Arsenal and the Dow No. 17 have been introduced. If, to a chemically treated or anodized magnesium surface, one of the chromate pigmented primers is first applied and this is followed by one or two coats of a good quality finishing enamel, an excellent protection will result, with a life of at least 1,000 hours when exposed to 20% salt spray.

When discussing the corrosion of magnesium, mention must be made of the electrolytic type, which can be very destructive. Magnesium occupies a very low position on the electromotive scale of potentials, so that it is anodic to practically every other metal. If magnesium is in contact with a dissimilar metal in a corrosive atmosphere, a galvanic cell is formed and the magnesium is consumed sacrifically. This property is made good use of for protecting other metals, as for example in ships' hulls, domestic water heaters, boilers and cables or pipes buried in the ground, but it must be prevented if it is the magnesium which is required to last. Put in a nonconducting barrier between the magnesium and the dissimilar metal to do this. It may be a heavily pigmented chromate compound or any good insulating tape or plastic.

It may still be asked: "Why magnesium? There are other useful alloys available which are cheaper."

Well, the iron-ore resources on this continent are being used up too fast. But with about 10 billion pounds of magnesium in one cubic mile of sea water and the fact that all the magnesium produced in the world so far could have been taken from about one tenth of a cubic mile, there is no danger to the supply of this particular metal. ★

U. S. Destroyer

(Continued from page 54)

third the standard steering gear for destroyers.

The twin rudders are mounted in roller bearings and fitted with seals. One of the rudders has medium steel plating and the other a plating of special alloy steel containing nickel so that a comparison of the effects of water flow, erosion and corrosion could be made.

The small air-conditioning fans used throughout the ship have air velocities higher than normal, and so smaller duct-work. Seventeen tons of air-conditioning is supplied by two compressor plants while sound boxes and duct-work insulation have reduced noise level.

At the beginning of the program in 1946 it was thought that the completed ship could be delivered in three years. This was an optimistic estimate and in 1948 a tentative completion date was established for 1950. Further delays resulted in the ship's delivery being held up until 1952.

The delays are to be expected in view of the vast amount of development that must go into new designs — and because of the scant information on fabrication techniques for certain of the special materials required for the unusual steam conditions. Many months were also lost as a result of material failures, modifications and delivery of components.

But the destroyer was at last delivered in September, 1952, commissioned and fitted out at Boston Naval Shipyard, and in June, 1953, got under way. In only six weeks she steamed nearly 2,500 miles to give the valuable at-sea experience everyone was waiting for.

So far the highest speed she has made has been 34 knots which corresponds to about 60% of the full-power rating of the ship. Deficiencies which prevented the use of higher powers are being put right and soon full-power trials will be held. Speeds close to 40 knots will then be reached. ★

Protective Coats

(Continued from page 38)

particularly pleasing appearance is wanted. Both chemical and anodizing treatments are available, some of which give a good basis for paint and others give considerable protection when used alone.

In general these coatings are thicker and more resistant to corrosion than the ones applied by chemical treatment. They can be given a wide variety of color by treatment with organic dyes.

Zinc has been used for more than a century because of its resistance to certain types of corrosion. It now is known that the corrosion resistance of this metal may be considerably increased by treatment with a solution containing chromate ions. The resulting very thin brown film may be used alone or under an additional organic coating.

It is best to use artificial protective finishes on aluminum and certain of its alloys under particularly severe conditions, or in order to obtain a certain color, hardness or other effect. Quite a lot of chemical treatments are available, some of the resulting coatings being useful by themselves and others make a satisfactory base for paint.

The most commonly used organic coatings are those of the paint, varnish and lacquer types. Although as a group they are not as corrosion resistant as the vitreous enamels, they are much less expensive, have a wide range of colors and (unlike the vitreous enamels) may be applied in the field. Some of them have excellent resistance to chemicals and so are particularly useful in the chemical and metallurgical industries. Nowadays considerable attention is being paid to bituminous coatings which, among other things are used for protecting buried pipelines and immersed metal structures.

Although there are other types of organic coating they are less important.

Despite the long history of protectives and the many important discoveries that have already been made, the story is nowhere near ending yet. Modern research equipment and today's highly trained men promise many new thoughts about coatings for the future. ★

Infra Red

(Continued from page 31)

is only a fraction of the total operating cost of the oven.

Radiant heat has now been successfully used for many industrial processes, including the drying coats and synthetic resin enamels; the drying of metal, paper, films, fabric, latex, plastic and impregnated parts like armatures. Synthetic enamels, like quick-drying enamels, ink, paint, varnishes and dyes can be dried in a very short time with good results.

Products treated with synthetic enamels which required between 20 and 45 minutes in the convection oven, can be dried in about a quarter of the previous time.

Here is a list of some of the uses to which infra-red radiant heat is now put:

For baking

1. Prime and finish coat of paint.
2. Insulation on electrical windings.

For degreasing

1. Metal products.

For preheating

1. Metal products to secure shrink fit.
2. Fibre, metal to make shearing and punching easier.
3. Glass closures prior to filling to prevent breakage.
4. Syrups, grease, oil, paint in containers, to facilitate flow.
5. Plastics prior to forming.
6. Metal prior to welding.

For miscellaneous

1. Soldering.

For drying

1. Metal products after baths.
2. Variety of special coats on metal, wood, paper, fabrics, leather and plastics.
3. Wet electrical equipment.

The reduction in baking time is perhaps the main factor which has brought such a wide acceptance for the process. ★

Phone & TV Guide

(Continued from page 28)

cycles. The carrier frequency for the new waveguide is about 50,000mc.

A major difference between transmission through the new waveguide and through previous systems is that the higher the frequency in the waveguide, the less the loss through attenuation. This is exactly the reverse of other forms of transmission.

Studies of waveguides have been in progress at the Bell Laboratories for nearly a quarter of a century.

In 1932 experiment showed that electric waves could flow through a hollow tube for several hundred feet and this was the foundation for later development work in this field. A fund of mathematical knowledge was built up and scientists studied many tubes in different shapes and of different materials.

This early knowledge was applied by Bell Laboratories in the development of radar during World War II when waveguides were used to funnel radar signals from an antenna to receiving equipment. Similar waveguides, and others of a more advanced design, are now in use in the Bell System to carry signals on microwave radio relay towers. And some of these, as well as the new long distance waveguide, are round.

Apart from the prospect of improved transmission with the long-distance waveguide, there is the possibility of using tiny wave lengths of the order of one millimeter (about a twenty-fifth of an inch). If this becomes possible, the waveguide of the future may be no thicker than a fountain pen and still carry tens of thousands of telephone messages.

I've no idea where he goes at nights; but they say he's busy designing a man.

Quotes

Points from current papers and speeches

AN SAE PAPER, "Chrysler Die Cast Aluminum Torque Converter Housings" by **F. R. Holliday,** describes the development of light metal torque converter housings. These housings are thought to be the world's largest structural die castings now used in automotive production. Of particular interest in the discussion is the fact that the success of this light metal application is due directly to the use of designs based on extensive experimental test results.

With automatic transmissions it was discovered that light metals and die casting techniques were most suitable for the intricate slots, holes and cavities in control valve bodies. Until recently, however, light metal die castings were not used for members subjected to high stresses. As a result of the experience gained with lightly loaded parts and the evolution of improved casting techniques, die castings are now used for the load-carrying converter housings where static and dynamic stresses are appreciable. Chrysler Corporation has used and is using light metals to a greater extent than other automotive manufacturers.

Many articles were written prophesying the engineering and styling features of the postwar car. Some of these articles predicted that the use of light metals would be extensive and that aircraft methods of construction would prevail, since automotive engineers had become acquainted with aircraft designs. In some cases these prophesies have come true, but in most instances the proposed designs were technically unsound or not economically possible.

During the last war, Chrysler Corporation engineers became well acquainted with aircraft materials and methods. Their best experience on light metal castings was obtained as a result of development work on a large aircraft engine. Early in this engine program it became evident that the design was largely dependent on the mechanical properties of the material. And it was found that many laboratory tests, using the newly available techniques of experimental stress analysis, were necessary to expedite the design development. Among the tests used in this engine program were a number for evaluating stress and rigidity.

Subsequent to this development, a comprehensive study was made of the possible production applications of aluminum in the postwar automobile. After the war, the use of light metals was investigated for many load-carrying members. In many instances, the light metal exhibited several advantages over the previous material and was released for production. For example, an aluminum die cast transmission extension was used for the semi-automatic transmission on some of the 1946 cars. Since then, experimental programs of this sort have continually been in progress. Use of light metals has helped keep car weights within reasonable limits, offsetting the weight increase due to all the power accessories, automatic features, and other accessories that have been added to the car in recent years. With the addition of car air-conditioning equipment, weight has become more critical, so that light metal applications are now even more important as a means of controlling car weights.

Members of the die-casting industry consider the development of the load-carrying aluminum torque converter housings a milestone in the use of large automotive die castings. As a result of experience, there does not seem to be any serious obstacle in the way of other successful automotive applications of light metals. It is felt that aluminum and magnesium die castings will allow a more conservative use of material and at the same time give the automobile better acceleration with greater economy and efficiency.

• • •

IN DISCUSSING STEELS and protective treatments for use up to 1,000 deg F, **H. J. Noble** and **W. H. Sharp,** in an SAE lecture, covered the material in three parts. Part one dealt with factors involved in selecting appropriate steels and emphasized the role of martensitic chromium steels, which combine strength with rust resistance. Prevention of and effect of rusting of these steels, as well as elevated temperature considerations, were discussed. Part two went into stress-corrosion of martensitic chromium steels and established the ranges in which these steels are prone to failure by this mechanism. Part three dealt with protective coatings, such as diffused nickel-cadmium, and set down the temperature ranges in which the various coatings may be employed.

• • •

A NEW TYPE of lightweight, high-strength, high-aluminum steel which can be fabricated into thin flexible, cold-rolled sheets has been made possible by a new process developed by metallurgists at the U. S. Navy's Ordnance Laboratory, White Oak, Maryland. Technical details of this non-strategic, ferritic-type alloy which combines heat and oxidation resistance with electrical resistivity are included in a new research report just made available to industry by the **U. S. Department of Commerce's Office of Technical Service.** The composition of the alloy, its properties, uses, and the melting, casting and hot- and cold-rolling techniques used in producing it in sheet form are detailed in the report.

Called Thermenol, the new compound is an iron-base alloy containing 15% to 16% aluminum and approximately 3% molybdenum. It is a modification of 16-Alfenol, a binary alloy previously developed at the Naval Ordnance Laboratory which, while inherently hard and brittle and possessing good magnetic qualities, could not be produced in usable sheet form. Experiments showed that, with the addition of small amounts of molybdenum, and a special high-temperature annealing process, stress-rupture life of the new combination could be made approximately 100 times that of the basic binary alloy at 1,200 deg F. These experiments led to the development of a process which, for the first time, permitted the fabrication of this and other high-aluminum alloys into thin, flexible, cold-rolled sheets.

Thermenol is oxidation-resistant to temperatures as high as 2,300 deg F. It exhibits extremely good corrosion resistance to oxidizing solutions and atmospheric conditions. Polished samples of Thermenol tested by constant exposure to the atmosphere and handled daily for about a year still retained their original polished appearance. These qualities, together with its low density—about 20% less than stainless steel—make it potentially useful as a substitute for stainless steel in aircraft or jet engines. Tables of comparative stress-rupture data on Thermenol and stainless steels show that it has superior properties to most ferritic stainless steels and is not far below the values obtained for austenitic stainless steels. high electrical resistivity — 160 micro-ohm-cm — indicates its probable usefulness for resistance heating elements; and its magnetic properties, and wear resistance promise usefulness in numerous magnetic applications.

In addition, Thermenol can be machined satisfactorily at room temperature, using a slow tool speed and sufficient coolant, and it can be arc- or spot-welded without difficulty. The navy metallurgists believe that this new development has a big future in modern industry wherever high strength sheet steel is used.

Advertising index — August

Editorial

Who Should Head The 'Product Design' Team?

WHAT KIND OF MAN makes the ideal product designer? With so much product design going on around us, it is surprising to find that industry is not very sure.

More than anything else, the doubt seems to come from the difficult marriage of art to engineering science that product design demands. Finding conflict between the partners, industry hesitates. Who, it asks, should head the design team — the artist or the engineer?

It should be the engineer! But only the engineer who can free himself to think creatively. This is a situation which should be faced. Consumer products must end in sales and although performance is, and will remain, the biggest test of a product's worth— it is not the only one.

There are signs that Canadian engineers are alert to the risk that product design could move toward other hands. More alert, perhaps, than a British engineer who is reported in the magazine "Design" as having said: "I cannot feel that I have anything in common with these industrial designers. They fiddle with designs which they know next to nothing about . . . they give one the feeling that art and design is all mixed up with unmade beds . . ."

Unmade beds? The engineer who spoke those words is making his; but there may come a time when he finds it less comfortable to lie on than he hoped.

Industry throughout the world is looking for the comprehensive designer. And when he is found, he will be no ordinary citizen.

He will need a broad knowledge of engineering principles; he will need to know the economics of production; he will need to be a materials expert. And in this knowledge alone lie years of study and experience. Yet it is not enough — is only, in fact, a beginning.

He must also have the creative spark. He must be culturally aware — able to turn the same critical eye on his product, as art, that he would turn on a broken bearing. His principal struggle is for a new freedom of thought. He needs freedom to adventure — with new arrangements, shapes and textures. He must be a student of human wants anxious that his product should delight, as well as serve, the people who buy it.

This is not part of an engineer's training today. Later on it may become so but, in the meantime, Canada's engineers must start a program of self-education to settle at once the question of who should design our products.

For the man with the technical know-how is two thirds along the road. Other claimants must jump the hurdles of a changing technology they little understand.

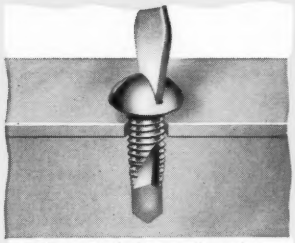
It would be astonishing if the engineer were overtaken in the race toward good product design. And it is certain it would be his own fault.

Why

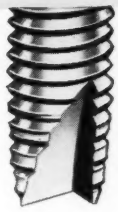
SHAKEPROOF® THREAD-CUTTING SCREWS

give a better fastening... faster!

Shakeproof Thread-Cutting Screws offer you immediate assembly savings.

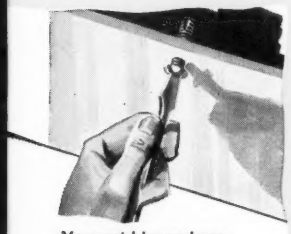


They cut their own threads, eliminate separate tapping operations completely.

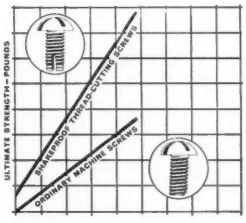


This thread-cutting slot exposes a sharp, serrated cutting edge.

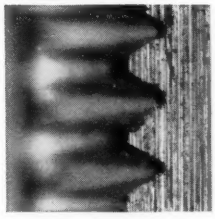
Shakeproof Thread-Cutting Screws actually work with true tapping action.



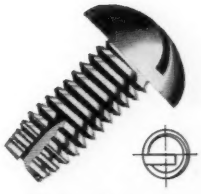
You get big savings. Just drill or punch hole and drive—that's all! No tapping, no tapping tools!



These hardened screws provide greater strength ... often permit use of smaller sizes.



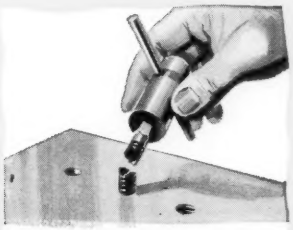
Self-cut mating threads assure a tight, vibration resistant fit.



Type 1 Thread-Cutting Screws are specially designed for use in hard metals.

Type 23, with wider thread-cutting slot, is for use in metals and plastics.

Type 25, with spaced thread, is designed for use with plastic materials.



Eliminate costly taps and tapping ... improve quality and cut costs at the same time.

Every screw is a cost saver when you specify Shakeproof Thread-Cutting Screws.

Free Sample Kit

Now ... make your own tests! See for yourself how Shakeproof Thread-Cutting Screws can save money in your plant. Write for your free sample kit today!

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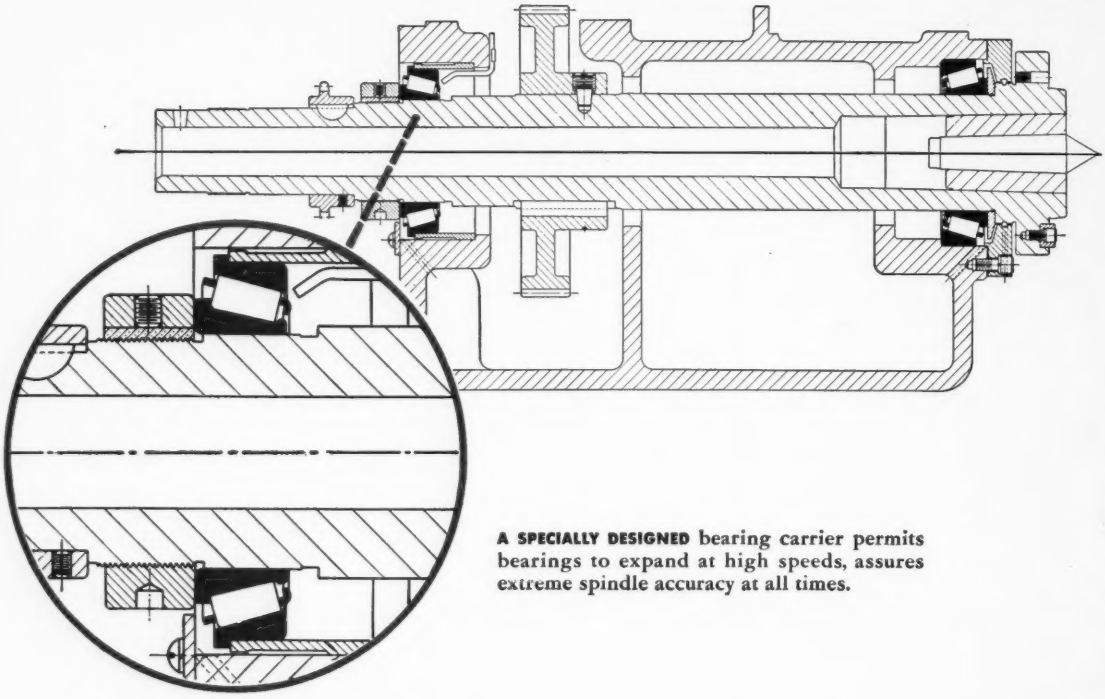
WORLD'S BROADEST LINE OF LESS-ASSEMBLY FASTENINGS

How to maintain extreme spindle precision from low to very high speeds:

TIMKEN bearings with semi-flexible mounting

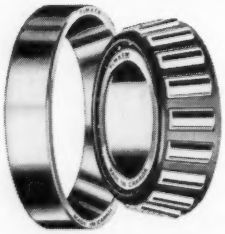


A SPECIALLY DESIGNED bearing carrier permits bearings to expand at high speeds, assures extreme spindle accuracy at all times.

THE Timken Company has an ingenious solution to the problem of maintaining a high degree of spindle precision in machine tools. At high speeds, bearings expand. Normally this would cause the bearings in a precision mounting to tighten up and become excessively preloaded. But engineers at the Timken Company have developed a semi-flexible mounting. The rear spindle bearing is mounted in a special carrier. The carrier is designed to permit the rear bearing to expand radially while the entire spindle assembly expands longitudinally. As a result the desired bearing setting is maintained under all operating speeds. Extreme spindle accuracy is maintained at all times.

Timken tapered roller bearings with these mountings have been applied to the spindles of many types of machine tools with great success. Of course not all machine tool spindles are required to operate at high speeds and over a variable range of speeds. The conventional Timken spindle mounting is entirely adequate for most machines.

Whatever your requirements, there are Timken tapered roller bearings to meet them. If not we'll find a new way, as we did when machine tool builders originally asked for precision bearings. And as we did when they asked for greater accuracy, which led to the famed Timken "O" and "OO" bearings. The Timken Roller Bearing Company, Canton 6, Ohio. **CANADIAN PLANT:** St. Thomas, Ont. Cable address: "TIMROSCO".



TIMKEN *Made in* **CANADA**

TRADE-MARK REG. IN CANADA AND U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

FOR CANADIAN INDUSTRY

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ⟊ AND THRUST ⟊ LOADS OR ANY COMBINATION ✳